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Joining Forces in Technology: Three Analytical Case Studies of Early Corporate-Sponsored Electronic Music

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by

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ABSTRACT

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by

Nicholas Wright Jurkowski

The close of World War II and the advent of the Cold War had effects far beyond the oft-explored realms of global alliances and domestic policy; this dissertation traces a path exploring how these grand geopolitical factors, and accompanying patterns in knowledge production, filtered from the larger intellectual climate to more localized cultural and artistic trends. I seek to show how application-focused trends in postwar knowledge and technology production (termed "Mode 2" by Michael Gibbons, Camille Limoges, Helga Nowotny, et al. in their 1994 book, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*) found an avenue into avant-garde art through the bourgeoning field of electronic music. This represents a break with historical trends, since the arts have generally functioned within older, discipline-focused, patronage-based models.

In addition to exploring how the historical context of the early Cold War informed the development of knowledge production generally, and electronic music specifically, I focus on three composers' activities at early electroacoustic studios in the years 1955-1965, as well as their accompanying sponsors: Milton Babbitt and the RCA Synthesizer at the Columbia-

Princeton Electronic Music Studio; Mauricio Kagel at the Siemens Studio for Electronic Music in Munich; and Toru Takemitsu at Sony's Electronic Music Studios in Tokyo. I hope to show how the broader intellectual climate of the United States and its satellites in the early Cold War period helped to shape both how a number of electroacoustic music studios were established, and how music was conceived of and composed there. Ultimately, I also aim to understand how these pieces fit into their composers' larger output and individual artistic goals, while at the same time using these cases to develop a more nuanced understanding of the broader cultural significance of early electronic music.

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A. Preliminaries

As World War II ended and battle lines for the Cold War were drawn, the world entered a new power dynamic, marked by a dualistic ideological and political struggle on a global scale, and underscored by the ever-present threat of mutual nuclear annihilation. This global struggle between America (and allied countries) and the Soviet Union constantly lurked in the background of every facet of life, from the expected realms of government policy and industrial production to less obvious realms like culture and art. This period saw a rapid development in the way that knowledge was produced and applied, and it was during this time that American institutions, both government and private, were quickly adjusting to this new paradigm. It is my hope to trace a path whereby we can explore how these grand geopolitical factors (and accompanying trends in knowledge production) filtered from the larger cultural climate to more localized artistic trends. This study focuses on a sampling of early electroacoustic studios, the composers who worked therein, and their accompanying sponsors. The broader intellectual climate of the United States and their satellites in the early Cold War period will serve as a context for both the way in which electroacoustic music studios were established, and the way electroacoustic music was conceived of and composed. Ultimately, I hope that this study helps to shed some light on how musical production, particularly that of the mid-20th century avant-garde, fits into larger patterns of postwar production and politics, as well as how those connections had ramifications to the music composers produced.

Before the discussing the history that concerns this study, it is necessary to define some terminology. Using “avant-garde” as an overarching descriptor is potentially perilous. Hubert

F. van den Berg notes: "The term "avant-garde" has served in certain sections of the historiography of the European arts as a common designation – a more or less fixed name – for a set of divergent, heterogenous phenomena that together form some sort of a single entity . . ."[1] The heterogeneity of composers and ensembles who later commentators[2] have grouped under the umbrella of the "avant-garde" designation tends to attenuate the term's value for describing a specific set of characteristics. For the purposes of this study, I use it to refer to modernist-oriented musical movements that favored dramatically reconfigured approaches to musical language (when compared with the common-practice tradition) such as the serialism of the Darmstadt circle, as well as the aleatoric or otherwise experimental music in the vein of John Cage. I am including most early electronic music in this designation, particularly since the composers who worked in that medium also generally composed acoustic music that would also be considered as part of the avant-garde.

Though representatives of these groups often had disagreements surrounding the validity of others' approaches, I believe that we can appreciate a fundamental similarity between them. Van den Berg notes that representatives of the (so-called) historical avant-garde "indeed understood themselves as some form of a unity."[3] By this, van den Berg does not mean to say that these artists took the same approaches, but rather that they were bound together by a theme of originality.[4] This was incredibly wide-ranging, but we can nonetheless conceive of it as a sort of decentralized whole; the avant-garde was, "a project . . . still as yet completed . . . best conceived as the lines and nodes of a rhizome-like network."[5] Though

1 Hubert F. van den Berg, "Avant Garde," in *Sound Commitments*, ed. Robert Adlington (New York: Oxford University Press, 2009), 15.
2 As Van den Berg notes, the term was rarely historically self-applied by artists or musicians. (Van den Berg, 21)
3 Van den Berg, 21.
4 Van den Berg, 24.
5 Van den Berg, 22.

individuals had wildly different methods and ideologies within this label, they shared a broader, exploration-based ideology.

One of the factors that ties members of the musical avant-garde together seems to have been a general conception of their compositional process as a kind of research, or at the very least, an exploration of the sonic realm in a way that could be conceived as research. Festivals like the Internationale Ferienkurse für Neue Musik, Darmstadt helped to give a central location where different musicians could present and promote their vision for the future of music. While the relationships between composers there were sometimes acrimonious, and they expressed often-divergent opinions about the direction music should be taking, Darmstadt still provided a sort of unity in that it acted as the setting in which these discussions and struggles could unfold.

I could not hope to give a comprehensive accounting of every studio or composer in this time period, nor of every individual political, cultural, or intellectual trend during the early Cold War. Rather, I will be exploring three individual case-studies that occur within a ten year period, from 1955-1965, situated within the United States or former axis powers which remained in their sphere of influence: Milton Babbitt, and the RCA synthesizer in the United States; Mauricio Kagel, and the Siemens Studio for Electronic Music in the Federal Republic of Germany; and Toru Takemitsu, and Sony's Sôgetsu Studios in Japan. These cases are well suited for comparison in that the studios all had a private, corporate interest as part of their founding. This helps to explore emerging trends in knowledge production in the "Free World;" I will situate these case studies within their individual cultural contexts, which in turn I will relate to a larger proposed model for knowledge production, the concept of Mode 2, as described in Michael Gibbons, Camille Limoges, Helga Nowotny, et al. in their 1994

book, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*.

There are a number of advantages to this approach. The first is that it allows for simultaneously tracing broader cultural and narrower music-theoretical developments; I hope to trace the full breadth of effects intellectual and political trends had on an artistic medium, from the conditions that created the music-as-research mentality, to the related way in which certain electronic music studios were created, and finally to how technologies interacted with compositional philosophies and aesthetics. It also offers a view into music as a kind of knowledge production, allows us to understand what kind of knowledge electronic music, in particular, creates, and how this knowledge creation varied in different geographical and cultural contexts. On the level of individual musical works, I hope to explore the ways in which the bourgeoning field of electronic music was shaped by the changing face of knowledge production in the early Cold War era, as well as how experiments in the electronic medium might make a lasting impact on composers' musical and aesthetic philosophies.

B. Occupational Government Policy, the Cultural Cold War, and the Avant-Garde

US government officials saw the ideological struggle between Soviet Communism and the Western fusion of democratic capitalism in stark terms, and portrayed the struggle as a zero-sum game. George Kennan expressed this view clearly in his famous *Long Telegram* of 1946, published in 1947 in *Foreign Affairs*:

> It is clear that the United States cannot expect in the foreseeable future to enjoy political intimacy with the Soviet regime. It must continue to regard the Soviet Union as a rival, not a partner, in the political arena. It must continue to expect that Soviet policies will reflect no abstract love of peace and stability, no real faith in the possibility of a permanent happy coexistence of the Socialist and capitalist worlds, but rather a cautious, persistent pressure toward the disruption and, weakening of all rival influence and rival power.[6]

Kennan believed that only response to such a situation "must be a long-term, patient but firm and vigilant containment of Russian expansive tendencies . . . Soviet pressure against the free institutions of the Western world is something that can be contained by the adroit and vigilant application of counterforce at a series of constantly shifting geographical and political points."[7] Science, technology, and knowledge production were key aspects to the plan to contain the Soviets, and their intersection with music will be a key focus of this dissertation. However, they were not the only realms reshaped by Cold War concerns, and it is first necessary to understand the cultural aspect of this struggle, which helps to give a broader historical context in which my case studies exist.

Leaders of both the Soviet Union and the United States understood the Cold War as being between two different world-views, and a vigorously-fought cultural side to this struggle erupted by the end of the 1940s. Each side was anxious to appeal to left-leaning intellectuals and present themselves as stewards and producers of art, music, and other cultural achievements. The cultural Cold War has been widely explored by authors like Frances Stonor Saunders (in *The Cultural Cold War*)[8] and Giles Scott-Smith (in *The Politics of Apolitical Culture*).[9] Both authors concentrate on the politics and funding of the wider struggle, tying cultural concerns with wider economic and political maneuvering, and

6 George Kennan (anonymously), "The Sources of Soviet Conduct" in *Foreign Affairs* (July1947), 566-582.
7 Kennan, 575-576.
8 Frances Stonor Saunders, *The Cultural Cold War (*New York: The New Press, 1999).
9 Giles Scott-Smith, *The Politics of Apolitical Culture* (London: Routledge, 2002).

exploring some of the ramifications of CIA support of cultural activities to a political end. While the U.S. government's intentional sponsorship of avant-garde art for ideological purposes is well documented by scholars like Serge Guilbaut,[10] there is no real critical consensus on the extent to which the U.S. government actively supported avant-garde music as policy. Government funding sources have a mixed record of what type of music to promote – as will be explored in a short history of the Congress for Cultural Freedom, sometimes it was neoclassical musicians that received promotion. However, some musicologists, like Richard Taruskin, contend that government support of the Darmstadt summer courses existed to explicitly favor the avant-garde, saying:

> The urgent wish, especially after 1949 when administration of the courses passed for the American occupying force to the new West German government, was to provide the musicians of the avant-garde with a protected space free from all social or political pressures . . . It became imperative, in short, to foster at Darmstadt in the name of creative freedom, exactly that which was subject to repression in the Soviet bloc.[11]

Regardless of their intentions, however, a great deal of government support flowed to composers whose music had apparent value in the eyes of the men the government tasked with demonstrating the artistic possibilities and cultural superiority of America's brand of democratic capitalism, compared with repressive Soviet-style communism. Overseers of this cultural policy, like Congress for Cultural Freedom Secretary General Nicolas Nabokov, or members of the Occupational Military Government's (somewhat ominously named) Information Control Division in Germany, were able to present and promote composers whose music they believed would reflect positively on the cultural achievements of the United States. This group certainly included members of the avant-garde, and this aspect of

10 Serge Guilbaut, *How New York Stole the Idea of Modern Art* (Chicago: The University of Chicago Press, 1983).

11 Richard Taruskin, *The Oxford History of Western Music, vol. 5* (New York: Oxford University Press, 2005), 22-23. (It is notable that the way Taruskin phrases this would seem to give credit for explicit support of avant-garde composition to the West German government, rather than the Americans.)

the cultural Cold War cannot be ignored as part of the period's backdrop and cultural fabric.

C. OMGUS and SCAP

At the close of World War II, the United States imposed occupying governments on the former Axis powers. Each country presented the occupying authorities with a unique case, though their ultimate goals for either country were essentially identical: the administrations sought to reshape Germany and Japan in the image of American-style capitalist democracy, in order both to prevent the future rise of regimes in the style of those they had just defeated, and also to serve as bulwarks against Soviet expansion. The cultural side of this reshaping was important for both the occupying governments in Japan and Germany, but the way each occupying force addressed cultural questions was very different, and seems to have been based on American conceptions of the respective countries' cultures. These policies would have tangible effects on the artistic direction the avant-garde took in their respective countries.

In the case of Germany, the United States Office of the Military Government in Germany (OMGUS) made "cultural reeducation" an immediate priority.[12] This effort sought to reorient German citizens away from Nazism and dictatorship, towards democracy. Among the more visible ways allied authorities undertook reeducation was by their reshaping and patronage of German radio stations. Americans initially eschewed overtly political reeducation programming, and instead spent airtime on familiarizing the populace with previously banned books and music.[13] The method which the Americans rebuilt the radio network in their zone of occupation had a dramatic effect on the way new music was disseminated.

12 Amy Beal, *New Music, New Allies: American Experimental Music in West Germany From Zero Hour to the Reunification* (Berkeley: University of California Press, 2006), 18.
13 Beal, 24.

Rather than privatize the system in the American model, or enact a state-controlled system in the vein of France or Nazi Germany, the allies opted for a decentralized but public model based on the system used during the Weimar Republic.[14] Collaboration between these stations gave all of West Germany access to a great variety of programming, and also provided smaller stations with technical know-how and recordings of live concerts, even if the stations had relatively modest budgets – this helped to foster a thriving new-music community in Western Germany.[15]

Additionally, OMGUS authorities sought to exhibit cultural products of American democracy to show the system's possibilities,[16] an effort that included both the patronage of European high culture and the widespread promotion of American music. This was a challenge, as the Germans expressed a general reticence to accept American music. Edgard Varèse noted a widespread doubt that Americans were a cultured people, saying to the *New York Times* in 1950:

> The Germans will listen to, but not accept, any suggestion as long as they are not convinced that they are coming from a Kulturvolk. And we are not entirely accepted today in Germany as a Kulturvolk. This we must fight for . . .The Europeans believe in the cultural elite, the artistic elite. We must show that we, too, are of the elite.[17]

While OMGUS authorities tried to exhibit America's cultural bona fides to the German people, they also recognized that "the reconstruction of the cultural life of Germany must be in large measure the work of the Germans themselves."[18] Consequently, there were a number of ventures which, while funded and approved by OMGUS, were carried out by Germans. The Darmstadt-based Internationale Ferienkurse für Neue Musik represents one of the most

14 Beal, 25.
15 Beal, 26.
16 Beal, 19-20.
17 Varèse, quoted in Beal, 47-48.
18 "Long Range Policy Statement for German Re-education," quoted in Beal, 39.

significant such projects. OMGUS officials licensed the proceedings and granted clearance to participants, and organizers received resources from the military government.[19] While they did not determine the precise artistic direction the European avant-garde would take, OMGUS's facilitation and support of the festival constitutes a direct, if not entirely intentional, patronage of avant-garde music. The particulars of the music produced do not seem to have been of vital importance to OMGUS officials; what mattered was that Germans were rebuilding their own cultural life in a way that represented the non-communist, non-Nazi requirements of the allied military government.

While the overall goal for the United States's occupation of Japan was very similar to that in Germany, there were a number of factors that made the Japanese occupation a very different case, and these typically revolved around racist and colonialist attitudes held by a number of Americans. While Americans viewed the Germans as racial equals and, in some ways, cultural superiors, there was a widespread belief the the cultural inferiority, and in some cases, the subhumanity of the Japanese. Historian Takeshi Matsuda notes the often graphic racial sentiments held by many Americans, quoting war correspondent Ernie Pyle, who, having covered the European war for years, recounts the general attitude towards the Japanese: “In Europe we felt that our enemies, horrible and deadly as they were, were still people. But out here I gathered that the Japanese were looked upon as something subhuman and repulsive, the way some people feel about cockroaches or mice..[20]”

The Japanese were quite aware of these attitudes. Consequently, American authorities understood the importance of not engaging in a blindly colonial occupation and reconstruction effort. Matsuda notes that, “Americans were aware that Japanese were

19 Beal, 38.

20 Ernie Pyle, quoted in Takeshi Matsuda, *Soft Power and its Peril: U.S. Cultural Policy in Early Postwar Japan and Permanent Dependency* (Stanford: Stanford University Press, 2007), 84.

particularly sensitive to the assumption that they were 'backward' or 'undeveloped.'"[21] John D. Rockefeller, a member of the Dulles peace mission to Japan, was quite influential in articulating American cultural policy there, understood the dangers of cultural imperialism, arguing for a "two-way street" of cultural exchange, which he felt would help mitigate the risk of prompting a resurgence of xenophobia among the Japanese.[22] Though many American officials were cognizant of the risks in patronizing the Japanese cultural identity, high level officials still managed to cause rows when they made their prejudices public. In one infamous episode, the Supreme Commander for the Allied Powers (SCAP), General Douglas MacArthur, publicly stated:

> If the Anglo-Saxon was say forty-five years of age in his development, in the sciences, the arts, divinity, culture, the Germans were quite mature. The Japanese, however, in spite of their antiquity measured in time, were in a very tuitionary condition. Measured by the standards of modern civilization, they would be a boy of twelve as compared with our development of forty-five years.[23]

Officials who understood how such comments actively damaged U.S. efforts in Japan, like Rockefeller, believed the best way to assure the Japanese of American good faith was to show genuine interest in Japanese culture, in order to establish a mutual appreciation.[24] Unfortunately, there were very few members of the occupation who had the necessary knowledge of both American and Japanese culture to create policies which would fit with the foundations of Japanese culture but demonstrate acceptably democratic ideals.[25]

The difficulty in establishing such a mutual respect was not solely a result of American prejudices. Japanese intellectuals were largely dismissive of American cultural achievements, having "imported a European disdain for American thinking and culture together with

21 Matsuda, 83.
22 Matsuda, 104.
23 Douglas MacArthur, quoted in Matsuda, 104.
24 Matsuda, 105.
25 Earle Earnst, *The Kabuki Theater* (Hawaii: The University of Hawaii Press, 1974), 260.

European enlightenment thought and cultures."[26] In spite of this, there was not an immediate nationalist backlash against the American occupation. The Japanese public experienced profound disillusionment with the previous military regime, having become fatigued by what Matsuda terms, "the premodern yoke of feudalism."[27] Furthermore, the sudden abolition of emperor worship, one of the first acts of the military government, left a sudden spiritual vacuum (a vacuum American authorities feared would be filled by communism.)[28] This general exhaustion would seem to be a fertile ground for realigning what the occupying forces viewed as the more destructive aspects of Japanese wartime culture, but the immediate American response was slipshod at best. While the occupation authorities in Europe sought to appeal to German cultural values, arguing for the worth of cultural products of American democracy, in the early years of the occupation in Japan, authorities simply imported American cultural products and censored any traditional Japanese cultural products that they believed advocated or reflected feudalism. The American SCAP official in charge of censoring Japanese theater during the occupation, Earle Ernst, noted:

> The score of Gershwin's *Rhapsody in Blue* was hurriedly sent for so that the Nippon Philharmonic Orchestra could acquaint its hearers with democratic music. Thornton Wilder's *The Skin of Our Teeth* and John Van Druten's *The Voice of the Turtle* were translated into Japanese and performed before small, bewildered audiences. None of these activities did any great harm, but neither, if the inculcation of the principles of democracy was the aim of the Occupation, did they do any great good.[29]

The American rush to inundate the Japanese with American products, in contrast to their efforts to convince the Germans of American cultural worth, is a product of what I believe to be the fundamental difference between the two occupational attitudes. Authorities implicitly held the view that where Nazism and the Holocaust were aberrations from the Germans' rich

26 Matsuda, 148.
27 Matsuda, 2.
28 Matsuda, 142.
29 Ernst, 260.

cultural tradition, while the attack on Pearl Harbor and Japanese behavior during the war were the direct products of their outmoded, inferior culture. The different approaches of US occupying policy in Japan and Germany certainly colored the situation for composers in those countries. As we will see in my discussion of Jikken Kobo and Toru Takemitsu, the discouragement of traditional Japanese culture left a number of Japanese artists and intellectuals grappling with the question of what modern Japanese art looked like, and the experimentalism this engendered took on a distinctly anti-institutional stance. By contrast, the avant-garde in Germany was, in general, comfortably institutionalized in government and US sponsored contexts.

Ultimately, the initial rush to censor all things traditionally Japanese as "feudal" and undemocratic subsided, in no small part thanks to the censors themselves. Earle Ernst and Faubion Bowers (General MacArthur's translator and aide-de-camp) and both fought to allow performances of proscribed Kabuki plays to be performed, and succeeded by 1947.[30] By the mid 1950s, cultural exchange between the U.S. And Japan had become much closer the Rockefeller's idea of a two-way street. A kabuki dance troupe toured the U.S. From 1955-56, and in 1960, the Grand Kabuki became the first authentic kabuki troupe to tour the United States.[31] While the U.S. occupation government did not seem to specifically promote American experimental music in Japan (unlike in Germany), being in the U.S.'s sphere of influence allowed Japanese composers access to American and European avant-garde music. A particularly important effect of this exchange for the Japanese avant-garde was a visit by John Cage in 1962, the ramifications of which will be explored further on.

A more direct promotion of modern American and European music occurred in 1961

30 Sameul L. Leiter, "Faubion Bowers," in *Asian Theater Journal* 28, no. 2 (Fall 2011), 316-317.
31 Leiter, 317.

with the Congress for Cultural Freedom's Tokyo "East-West Music Encounter" conference, where a number of Japanese, Indian, European, and American musicians and composers gathered to give concerts and papers about their respective musics. This conference featured both in-depth explorations of western avant-garde music theory and gagaku in an attempt to further foster the "two-way street" approach. Figures of the Western avant-garde like Iannis Xenakis and Elliott Carter lectured on their musical approaches, while musicians from India and Japan, like Thakur Singh and Sukehiro Shiba, gave presentation about traditional music from their respective countries.[32] Though its success in this regard is a matter for debate, the conference was well in line with the Congress's previous efforts to appeal to leftist intellectuals, and its efforts are helpful in understanding the US governments interaction with avant-garde art an music, the history of which can be murky and contradictory.

D. The Congress for Cultural Freedom

As the Cold War ramped up, both the Soviets and Americans began cultural offensives to appeal to intellectuals, particularly those in countries that were either unaligned or viewed as vulnerable. These offensives took many forms, and one of the most influential was the Soviet Union's "Cultural and Scientific Conference for World Peace," hosted at the Waldorf-Astoria hotel March 25, 1949.[33] The conference constituted an attempt on the part of the Soviets to establish their particular brand of communism as the ideology of choice for peace-loving artists and intellectuals everywhere. One of a number of Soviet-hosted "Peace Conferences,"[34] the Waldorf Conference featured prestigious cultural figures from the Soviet Union such as composer Dmitri Shostakovich (whose involvement in the conference was

32 Executive Committee for 1961 Tokyo East-West Music Encounter, *Music East and West: Report on 1961 Tokyo East-West Music Encounter Conference*, 1961.
33 Stonor Saunders, 46.
34 Mark Carroll, *Music and Ideology in Cold War Europe* (Cambridge: Cambridge University Press, 2003), 25.

forced by the NKVD) and novelist Aleksandr Fadeyev. [35] However, the inclusion of prominent American authors, artists, and scholars such as Arthur Miller, Norman Mailer, Lillian Hellman, and Dashiell Hammett[36] provoked more worry for Americans. The CIA could not allow this type of Soviet propaganda to take hold. Frances Stonor Saunders quotes CIA agent Donald Jameson regarding the Waldorf Conference:

> It was the tip-off that there was a massive campaign launched in the West on an ideological assertion of influence at a political level . . . we now understood that it was necessary to do something about it. Not in terms of suppressing these people, many of whom of course were very noble types. But rather as part of a general programme looking toward, ultimately, what we now can call the end of the Cold War.[37]

The official response took shape in the formation of the CCF, an international umbrella organization tasked with promoting American and Free-World culture abroad (the CCF's American affiliate was the ACCF, The American Committee for Cultural Freedom, headed by Sydney Hook). In particular, the CCF targeted leftist intellectuals with Soviet sympathies who were not actively communists. From its beginnings in Berlin in 1950 until 1967, the CCF staged numerous festivals of art and music, as well as other allegedly apolitical cultural events.[38] The organization found funding from a number of sources, including groups like the Ford Foundation, and a number of private donors. It received additional funding covertly through the CIA, a fact which California-based *Ramparts* magazine brought to light in an exposé in 1967. The CIA learned that *Ramparts* reporters were pursuing leads within its various front organizations in 1966, and embarked on a vicious campaign to discredit the publication and its reporters. Officials assumed the reporters acted as a vehicle for Soviet subversives, though could not find any evidence of foreign financing.[39] In spite of their

35 Carroll, 25.
36 Saunders, 53.
37 Donald Jameson, interview with Frances Stonor Saunders, Washington, June 1994, quoted in Saunders, 56.
38 Scott-Smith, 1.
39 Saunders, 381.

muckraking campaign, the CIA could not stop the magazine from ultimately publishing its report, which the national press then picked up.[40] Revelations of CIA funding greatly undermined the organization's credibility, ultimately sinking its English-language cultural journal, *Encounter*. When officials changed the organization's name to the International Association for Cultural Freedom they fooled no one, and with no new sources of funding, the organization closed down for good in 1977.[41]

Through the CCF, the United States government attempted to promote democratic-capitalist culture by sponsoring artists and musicians whose work was deemed bourgeois or otherwise unacceptable by Soviet Cultural authorities. The extent to which the American government acted as patron to avant-garde visual art is fairly well documented. Art historian Serge Guilbert writes that during the late 40s and early 50s, "Cultural magazines published in Europe with CIA funds mushroomed. The American liberal spotlight now focused on art and intellectuals."[42] These cultural figures now acted as figureheads for Western cultural achievement. Guilbert continues, "The glamorized and popularized art of abstract expressionism became the avant-garde wedge used to pierce the European suspicion that Americans were only capable of producing kitsch.[43]" The CIA had a medium that could be used to counter negative stereotypes about the supposed deficiencies in American art. Avant-garde art had a distinct political purpose, and therefore was a viable area for the United States government to support.

Though government officials were initially skeptical of abstract expressionism specifically (and the avant-garde in general), Jackson Pollock's abstract expressionism

40 Saunders, 381.
41 Ian Wellens, *Music on the Frontline* (Burlington: Ashgate Publishing, 2002), 3.
42 Serge Guilbert, *How New York Stole the Idea of Modern Art* (Chicago: University of Chicago Press, 1983), 203-204.
43 Guilbert, 205.

became a symbol for the power of the individual creation and risk-taking that Western democracy allowed, and that Soviet communism stifled.[44] The Soviets had little use for avant-garde, non representational art, which Party officials lambasted as decadent, Bourgeois, and "formalist." Officially supported Soviet Artists worked entirely within the Socialist Realist aesthetic. Consequently, by championing the avant-garde, the US could highlight the cultural rigidity of Soviet state policy.

Abstract expressionism has a possible musical counterpart in serial and electronic compositions. Not only did each medium prize non-representation and some degree of autonomy from mundane life, but each struggled to find a popular audience, and received mixed critical appraisals. Because of its non-representational nature, the cultural values that avant-garde works project is unclear, and government officials did not know if such works covertly promoted some sort of subversive agenda. However, while it appears that officials in the US government eventually sought to specifically promote avant-garde art, evidence that they actively promoted avant-garde music in particular seems scant. Instead, they embarked on a pattern of support for any music that might have provided an edge in establishing American cultural capital. In America and Europe, serial and electronic music – styles which some (though by no means all) composers prided as being self-consciously apolitical[45] – flourished, and indeed rose to prominence with the help of government subsidies, in spite of different government officials' contradictory attitudes towards the aesthetic. Over the course of two music festivals hosted in 1952 and 1954 (in Paris and Rome, respectively), by the Congress for Cultural Freedom, there is a progression showing avant-garde music moving

44 Mark Carroll, *Music and Ideology in Cold War Europe* (Cambridge: Cambridge University Press, 2003), 169.

45 Boulez, for instance, invoked Lévi Strauss in justifying his views that serialism "atomised" music, and stripped it of its acculturation. (see Gibbons, 92-93).

from a fringe style favored only by small groups of specialist disciples to one more widely accepted[46] by critics. By the 1961 Tokyo conference, figures from the avant-garde featured prominently. This transition is difficult to track, but no doubt has much to do with the personal opinions of the Congress's general secretary, Nicolas Nabokov.

Nicolas Nabokov (the cousin of *Lolita* author Vladimir Nabokov) was a white Russian emigre and a composer of some note, though now more remembered as a *bon vivant* and champion of high culture.[47] He entered US government service during World War II as a translator, and later moved to Berlin in 1945 to help re-establish German cultural life following the end of the war. Here, working for OMGUS, Nabokov met Michael Josselson, the man who would later become a covert CIA liaison to the CCF. Josselson became instrumental in organizing the first Berlin congress that led to the founding of the CCF, the executive committee of which named Nabokov secretary general in 1951. Conductor Robert Craft described Nabokov as, "uniquely qualified for this, speaking German and French as fluently as Russian and English, and possessing a knowledge of European culture ranging far beyond music."[48] Craft went on to praise his knowledge of international politics, saying "moreover, as a member of a prominent family in the Russian liberal movement, Nabokov was at least as informed about East-West politics as were the leaders of the Allied governments."[49]

During his tenure with the CCF, Nabokov oversaw a number of music festivals, designed to showcase the artistic possibilities of American democratic capitalism. The first, held in

46 Though not necessarily enjoyed.
47 He seems to have thought of himself in these terms as well. The subtitle of Nabokov's autobiography is, "Memoires of a Russian Cosmopolitan." (Nicolas Nabokov, *Baghazh,* (Kingsport:: Kingsport Press, inc.) 1975.
48 Robert Craft, quoted in Wellens, 3.
49 Robert Craft, quoted in Wellens, 3.

Paris in 1952, would be difficult to categorize as a success. This is due to both Nabokov's programming choices and French political objections to the festival. Nabokov's tastes in programming reflected a decided musical partisanship. He favored neoclassicism his entire life – he composed in the style, and never embraced serial music, at least on an aesthetic level. Of the thirty-two concerts that comprised the festival, only one program featured exclusively atonal and serial works,[50] and the rest of the festival concerts all but ignored atonal works. Alban Berg's opera, *Wozzeck,* became a notable exception, most likely because its subject matter (which deals with themes of duress and torture) fell neatly within the festival's theme of the nobility of the human spirit in the face of tyranny.[51]

The neoclassical aesthetic championed at the Paris festival reflected Nabokov's views of the CCF's larger philosophy – just as neoclassicism represented a modern custodianship of the great music of the past, championing neoclassicism showed that the non-communist west was the custodian of European artistic tradition. Nabokov reinforced the view of an artistic progression and inheritance by programming a large number of works composed prior to the 20th century. In championing European cultural achievements of the past (in many cases, presenting them with the Boston Symphony), the festival ran afoul of many in France who felt that the United States had no cultural authority to do so. Part of this attitude might be attributed to French insecurity following the Second World War. *New Yorker* reviewer Janet Flannery quotes a young Frenchman who summed up this side of French objection:

50 And Nabokov did not put the program for that concert together – rather, critic Fred Goldbeck arranged the program for the atonal concert.

51 Carroll, 19.

> All we French have left, he said, after the physical, military collapse of 1940 is our unshaken belief in our civilised, cultural superiority . . . Modern contemporanean art [sic], modern contemporanean music were born in Paris . . . our mental climate gave them birth, even if some of their fathers were foreigners. Now you bring their works back to us . . . on a golden salver we cannot afford.[52]

Many French observers felt the festival constituted a seizing of all that they had left in the aftermath of defeat and Vichy collaboration by a young, arrogant power. The head of the Paris Opera's ballet troupe, Serge Lifar, angrily railed against the CCFs crusade "against a possible and unforeseeable cultural subjection (by communism)."[53] He continued: "Dear sirs, you have made a big mistake: from the point of view of spirit, civilization, and culture, France does not have to ask for anybody's opinion; she is the one that gives advice to others."[54]

In all, the combination of CCF naivete and Parisian cultural chauvinism meant that the Paris festival had a mixed reception, at best. The programming for the CCF's next concert in Rome took a decidedly different tack. Nabokov announced plans for the next festival in February 1953, and in his programming, framed the festival as focusing on young and upcoming composers, no doubt in an attempt to sidestep criticisms that the Paris concert focused too much on neoclassical works and works from the established canon. He wrote that the festival had three primary aims:

1. To give young composers opportunity of having their works played and appreciated internationally.
2. To enlarge international repertoires by the addition of new names and works.
3. To create a meeting place where composers, performers, and critics may have the same personal contacts which have been enjoyed for many years by the exponents of other arts.[55]

52 Flanner, quoted in Wellens, 57.
53 Serge Lifar, quoted in Saunders, 122.
54 Serge Lifar, quoted in Saunders, 122.
55 "Top Musicians Open Festival on Sunday," in *The Washington Post*, April 2nd, 1954.

The extent to which Nabokov and the CCF explicitly promoted dodecaphonic (or otherwise avant-garde) compositions is a matter of disagreement among scholars. However, contemporary reviews and dispatches from Rome unequivocally stress the prominence of atonal music at the festival. While it is certainly true that not all of the fifteen concerts at the Rome Festival featured serial or atonal music, correspondents from a number of newspapers identified the composition contest as the festival's prominent feature, all of whose winners were dodecaphonic works.[56] A *London Times* correspondent's rather lukewarm appraisal of the festival also described the importance of the competition, and the narrowness of the compositional aesthetic, writing that the music at the Rome festival, "was perhaps less representative of the twentieth century as a whole than that performed at the May Festival in Paris two years ago."[57] The correspondent nonetheless recognized that festival more fairly represented current trends, and reported, "Nearly all the works submitted for the competition were in the now fashionable twelve-note, or 'serial' idiom, as indeed were most of the other contemporary works heard in the programmes of the congress."[58]

The rather sudden change in the type of classical music promoted by Nabokov and the CCF between the Paris and Rome festivals raises questions about what precipitated the change, and for what reasons. Mark Carroll posits a few possible reasons: First, that serialist

56 The overall winner were Mario Pergallo, Wladimir Vogel, Gisheler Klebe, Jean-Louis Martinet, and Lou Harrison. The assessment that all the winner were dodecaphonic comes from Michael Steinberg, "Conference of Musicians in Rome," *NewYork Times*, May 2, 1954, X7.

Frances Stonor Saunders and Mark Carroll both write that atonal music played a central role in the Rome festival. Saunders writes of the festival, "With a heavy concentration on atonal, dodecaphonic composition, the aesthetic direction of the event pointed very much to the progressive avant-garde..." (Saunders, 223) In contrast, Hugh Wilford and Ian Wellens downplay the role of avant garde music at the festival. Wilford writes, "It would, however, be wrong to suppose that the 1954 Rome competition marked the conversion of the CCF to 'serialist orthodoxy.' The twelve-tone school failed to dominate the event, and the likes of Babbitt and Cage continued to be ignored by the Congress." (Hugh Wilford, *The Mighty Wurlitzer* [Cambridge: Cambridge University Press, 2008], 110). The use of this quotation is rather misleading. The phrase "serialist orthodoxy" originally appears in Saunders. The conversion to "serialist orthodoxy" to which Saunders refers is not of the CCF officials, but of Stravinsky's personal conversion to serial composition, so it isn't entirely clear what Wilford is trying to accomplish by using the quotation.

57 "Modern Music: No Masterpieces at Rome Congress," *London Times*, April 27th, 1954.

58 "Modern Music: No Masterpieces at Rome Congress," *London Times*, April 27th, 1954.

music's revolutionary qualities had tempered, and it no longer had the potential to "derail" the Congress's cultural agenda as an unknown art-form with an unclear message.[59] This seems rather unlikely – serial techniques were by no means novel in 1952, and certainly any research at all on the part of organizers would have revealed Soviet distaste for atonal music. There is no real likelihood that CCF/CIA officials would have concluded that atonal music threatened the CCF's message (though, I suppose that would not have precluded them from finding one). The second possibility that Carroll discusses seems more plausible, but unfortunately I know of no documents that expressly support it. Carroll argues that just as Pollock's abstract expressionism came to typify individual creativity and "risk-taking,"[60] so to did serialism. There is nothing in Nabokov's written opinions that would grant explicit credence to this theory, but the possibility certainly exists that he began to respect its possibilities, particularly after Stravinsky, whom he held in great regard, began experimenting with serialism in the early 1950s.

Though the significance of the increased presence of avant-garde composition at the the Rome festival is not entirely clear, all accounts seem to agree that the Rome festival did not represent the same overt effort to establish American cultural capital as the Paris festival. Commentator Christopher Lasch observed in retrospect that the Congress displayed a shift to a greater sophistication towards European neutralism, and sought to change from propagandizing to a more measured (though still pro-American) discourse.[61] Still, given the CCF's reputation for promoting American interests, political connotations to their festivals were impossible to diffuse, even if they self-consciously tried to avoid them. This was certainly true with the CCF's 1961 Tokyo festival, "East-West Music Encounter." The

59 Carroll, 169.
60 Carroll, 169.
61 Christopher Lasch, "The Cultural Cold War," in *Nation* (1967), cited in Carroll, 167.

festival, in addition to musical performances, featured composers and scholars from the United States, Europe, Japan, Vietnam, and India giving papers on various aspects of Eastern and Western music, as well as their historical and potential future interactions. This conference seems to heel very close to Rockefeller's idea of a "two-way street" of cultural exchange. The panel was fairly evenly divided between Western and Eastern panelists. The Western side, continuing the trend set at Rome, featured a number of representatives from the avant-garde, including Elliott Carter and Ianis Xenakis. The Japanese avant-garde was also represented, with Makoto Moroi giving a paper, as well as numerous papers about Indian classical music and *gagaku*.[62] Though there was no overt politicization, the festival could hardly escape the conversation, since, as commentator Reiko Maekawa notes, neither Russia nor China participated in a festival that was allegedly an examination of East-West interaction.[63] She notes *Newsweek's* observation that "Tokyo's first East-West Music Encounter had developed just the sort of political overtones that the festival had tried to avoid," and that "Leftist critics and composers in Japan boycotted Encounter."[64] It's interesting to note the amount of criticism the CCF's festivals attracted from the left, particularly when other cultural activities and organizations that were ultimately beneficiaries of U.S. government largesse (the Darmstadt festival, for example) attracted comparatively little. Presumably, this can be explained by the overtly promotional connotations of CCF activities, involving a number of Americans in prominent roles. Darmstadt, by contrast, seemed apolitical in spite of OMGUS sponsorship, no doubt in large part because control of

62 For a full listing of papers given at the conference, see *Music—East and West: Report on 1961 Tokyo East-West Music Encounter Conference*, ed. and publ. Executive Committee for 1961 Tokyo East-West Music Encounter (Tokyo, 1961)

63 Reiko Maekawa, "The Rockefeller Foundation and the Intellectual Life of Refugee Scholars During the Cold War" (2009), on The Rockefeller Archive Center, http://www.rockarch.org/publications/resrep/maekawa.php (accessed 5-22-14).

64 From the May 8, 1961 issue of *Newsweek*, quoted in Maekawa, 2009.

the festival was in the hands of Europeans who did not hold promotion of American culture as a specific goal.

The contradictory attitudes that different government officials displayed towards modern music would seem to imply the lack of a centralized policy. Undoubtedly, CIA officials had more pressing matters to attend to than whether or not avant-garde music exhibited "American" values and cultural achievement. Furthermore, they typically did not have training in artistic fields, and, while they may have appreciated cultural pursuits and recognized them as important, they promoted specific aesthetics only if they achieved the agency's primary goal: halting communist progress. The seemingly scattershot approach taken in their cultural operations helped to hedge their bets. The Paris and Rome festivals and art exhibitions attempted to appeal to European "high culture" aficionados, while organizers used American musicals and jazz orchestras to reach a more middle-brow group, and were happy to use Hollywood for more mass-market appeal.[65] They tried to exploit any possible advantage, and ultimately did so with varying success.

While indirect or direct government patronage of avant-garde composers undoubtedly helped individual composers and sets the larger structure within which composers lived and functioned, I believe it was a broader trend towards "scientization" and research that would have the most widespread effect on the avant-garde. Rather than being a direct theater of the cultural Cold War, this was the more indirect result of the changing face of knowledge production due to technological concerns. Early electronic music is uniquely suited to exploring this, since the scientizing aspects of its development is not simply conceptual or rhetorical; there was genuine need for technical expertise and advancement if electronic

65 See, for example, Hugh Wilford's example of the CIA sponsored production of *Animal Farm*, Wilford, 118.

music was to become viable. Additionally, as we shall see, this attitude also extends to the way many composers perceived of the act of composition itself.

E. The Early Cold War Research Revolution and Art as Research

Technological superiority served as a key tool for military containment, and the need to out-compete and out-innovate the Soviet Union and their satellites helped to dramatically reshape the way the United States and their NATO allies developed new technologies. Science and technology research with military applications, particularly centered on nuclear weaponry, had, of course, grown during World War II, but drastically ballooned once the Soviets had successfully tested an atomic bomb in 1949. In a 1994 workshop on the role of science and technology in the Cold War, the National Science Foundation concluded that while the root of the expansion in public-private cooperation in the science and technology realms was in wartime efforts like the Manhattan project, "it seems clear that the Cold War served as the cement for a vast new scientific structure."[66] A large part of this structure would come to be known as the military-industrial complex, which President Eisenhower believed played a transformational role in how research was done. He noted that research, "had become more formalized, complex, and costly," and that the University system, "historically the fountainhead of free ideas and scientific discovery, has experienced a revolution in the conduct of research."[67]

The rise of large, government-funded research projects for military use makes sense in the context of the early Cold War power struggle. As physicist and historian Dominique Pestre writes, the fields of radio and electronics were altered by an influx of government-

66 "Science, Technology, and Democracy in the Cold War and After: A Strategic Plan for Research in Science and Technology," *A Report Prepared for the National Science Foundation*, workshop held in September 1994. Report accessed at http://www.cmu.edu/coldwar/NSFbookl.htm, 3-20-2014.

67 NSF report, accessed 3-20-2014.

sponsored research, and the field of materials "completely reshaped as as an industrial and academic field thanks to military expenditure" in the late 1950s.[68] This period saw the expanded establishment of industrial research laboratories and think tanks, oriented to a number of different goals, from developing consumer products to developing military technologies, to broader goals like ending communism.[69] These organizations featured collaboration between specialists from a number of different fields, and began changing the face of how we viewed knowledge, how it was produced, and to what end it was used. The question of how this fundamental change in one sphere of technological and scientific research affected spheres of science and technology without direct military applications is a difficult one, and an area of scholarly debate. The NSF report noted that their workshop participants "found the gradual 'scientization' of disciplines and educational processes to be characteristic of much of the 20th century."[70] However, there was no clear consensus on whether or not this tendency was affected specifically by the circumstances of the Cold War. Though the line connecting Cold War policies and the "scientization" is fuzzy, the result of the massive restructuring of the research apparatus in American universities and its accompanying influx of lucrative government sponsorships for research with military application seems to have had the effect of encouraging other disciplines to adopt methodologies and approaches associated with newly expanded research and development laboratories. Taruskin certainly seems to think this was the case, writing that after the launch of Sputnik:

68 Dominique Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading," in *Minerva* 41, no.3, Special Issue: Reflections of the New Production of Knowledge, 2003, 249.
69 Pestre, 249.
70 NSF report, accessed 3-20-2014.

> American scientists and politicians made educational reform, particularly in science and technology, a cold-war priority. Government investment in scientific endeavors – "big science" as it was called – gave scientific advancement in peacetime something of the sense of urgency that wartime bomb development had commanded. Any argument that proceeded from "scientific" premises could now catch something of that urgency.[71]

Taruskin places Milton Babbitt as an archetypal example of this, and with good cause. In Babbitt's article, "Who Cares if You Listen?" (originally titled "The Composer as Specialist") he certainly expresses this "scientizing" tendency:

> The time has passed when the normally well-educated man without special preparation could understand the most advanced work in, for example, mathematics, philosophy, and physics. Advanced music, to the extent that it reflects the knowledge and originality of the informed composer, scarcely can be expected to appear more intelligible than these arts and sciences to the person whose musical education usually has been even less extensive than his background in other fields.[72]

Babbitt positioned modern music as a kind of research. The question of exactly what type of knowledge research in music (and art in general) produces is difficult to answer. As Elliot Eisner writes in "Art and Knowledge," "The idea that art can be regarded as a form of knowledge does not have a secure history in contemporary philosophical thought."[73] The framing of art as a form of knowledge production gains increasing purchase throughout the 20th century, and is developed differently under different ideological regimes: capitalism and communism both contribute to ideas of an artist's place in society, and both play a role in framing art as different types of production. Communist thinkers believed that artists, like all members of a socialist state, had to be producers, first an foremost, but could not be allowed to create a product that could be commodified. Non-communist countries continued to prize art as a product of an individual's freedom to express themselves, and critics began to conceive of acts of self-expression as producing knowledge. The circuitous development of

71 Taruskin, 157.
72 Milton Babbitt, "Who Cares if You Listen," *High Fidelity* (February, 1958).
73 Elliot Eisner, "Art and Knowledge," in *Handbook of the Arts in Qualitative Research*, ed. Knowles and Cole (Los Angeles: Sage, inc. 2008), 3.

art-as-knowledge-production helps to clarify the type of knowledge to which avant-garde musicians and artists felt they were contributing.

Emphasis on art specifically as a form of production gained popularity among Marxists, and consequently, in the early days of the Soviet Union, writers and artists engaged in vigorous discussion about their role in a workers' state. Communists sought to transition from a culture devoted to bourgeois consumption to proletarian production. Writer and playwright Sergei Tretiakov describes how communists of the era viewed pre-revolutionary art:

> Are there really responsible, leading minds in the sphere of "revolutionary" art who say, for example, that theater is a "means to fill up the leisure time of proletariat weary from the work day?" We must remember that it was the curse of forced labor that actually generated this need in its day . . . art was the best way to escape from their drawn out daily routine into other worlds . . . thereby (imbuing) them with the inert psychology of petty-bourgeois contentment.[74]

The alternative for many communists in the pre-Stalinist commintern, including both Tretiakov and Bertolt Brecht, was a sort of democratization of art. Brecht advocated for art as socialist education, and focused his recommendation on "epic theater," a hybrid form of theater designed to instruct the audience.[75] Tretiakov advocated doing away with the line between artist and public, essentially doing away with specialists and having the populace at large engage in artistic pursuits.[76] The dubious aesthetic results of such a practice are entirely the point: Tretiakov was trying to avoid art as an aesthetic object; his goal was art as communal instruction.

The early communist side of art-as-knowledge-production is only peripherally related to my current study, but it is important for two reasons. The first is that it marks a large-scale shift in what many artists felt was their role in society. Artists were now producers, as much

74 Sergei Tretiakov, "Art in the Revolution and the Revolution in Art," in *October* 118 (2006, orig. 1923), 18.
75 Bertolt Brecht, *Bertolt Brecht on Theater: The Development of an Aesthetic,* trans. John Willett (New York: Hill and Wang, 1957), 31-35.
76 Tretiakov, 18.

as someone who worked in a factory or farm. This conception had an effect on artists whose work is not specifically communist – for instance, Andy Warhol adopted the moniker *The Factory* for the New York studio where he produced the bulk of his artistic output. His pop art offered an embracing of commodification in a way that socialist artists could not, but still was somewhat reliant on the image of producing (in this case production of something to be consumed) as part of its identity.

The second reason for its importance is that it shows a visible opposition between communist art and much of the avant-garde music produced in America's sphere of influence. Given the opposing goals and structures of capitalism and communism, it is not surprising that artistic approaches under each system would also be divergent. That the crucial philosophical differences are specialization, and the accompanying distance between artist and audience, may not be quite as intuitive. However, specialization is one of the key tenets of art as knowledge production in a capitalist structure, either explicitly (as in the case of Babbitt) or implicitly. If avant-garde music can be thought of as knowledge production, then it is a very specialized form of knowledge.

The areas of knowledge to which art might contribute has been the subject of discussion since at least the mid-20th century, and ties directly to the much older discussion of what constitutes knowledge. Elliott Eisner traces some of the discussion, and how it is relatable to art, summarizing different categories of knowledge according to Aristotle:

> The three types of knowledge he identified were the theoretical, the practical, and the productive. The theoretical pertained to efforts to know things that were of necessity, that is, things and processes that could be no other way than the way they are . . . the processes and products of nature. Practical knowledge was knowledge of contingencies . . .the local circumstances that need to be addressed if one was to work effectively or act intelligently with respect to a particular state of affairs. The productive form of knowledge was knowledge of how to make something.[77]

Subdividing knowledge in this way allows for nuance in a situation. Eisner gives the example of a medical relationship, with a doctor saying, "I remember the patient quite well, but I do not have a diagnosis for his illness."[78] In an Aristotelian understanding, two forms of knowledge become manifest and exist concurrently in one situation. However, both forms still rely on a type of concrete certainty to define themselves. In short, under the traditional model, knowledge is created when activities result in new, concrete information. It is difficult to place most art in a context where this would be the case. Consequently, we must look to other models.

Modern models dating from the middle of the 20th century have facilitated more ineffable forms of knowledge. For instance, we *know* what water tastes like, but we don't really have a way of completely conveying the sensation through language.[79] This opens to door for the act of evocation being a sort of knowledge production. In examining what art seeks to express, Susanne Langer writes, "I think every work of art expresses, more or less purely, more or less subtly, not feelings and emotions the artist has, but feelings and emotions the artist knows; his insight into the nature of sentience, his picture of vital experience, physical, emotive, and fantastic."[80] It might be difficult to imagine how this description might apply to avant-garde music – especially considering so much of what categorized Western avant-

77 Eisner, 4.
78 Eisner, 5.
79 Eisner, 5.
80 From Susanne Langer, *Problems of Art: Ten Philosophical Lectures*, quoted in Eisner, 7.

garde music of the early postwar period was its intentionally non-representational and abstract nature. If an artist specifically tries to distance their work from overt ties to emotion and what would normally be considered the human experience, especially through what amounts to either automated procedures (as in some applications of total serialism) or chance procedures (as with Cage), can we understand their artistic efforts to produce Langer's "insight into the nature of sentience?" Stockhausen would seem to believe so; he holds that the newness of the sounds themselves can trigger transformation, which would, presumably, include some type of insight or realization. He elaborates in his 1972 lecture on sound to the Oxford Union:

> New means change the method; new methods change the experience, and new experience changes man. Whenever we hear sounds, we are changed; we are no longer the same after having heard certain sounds, and this is the more the case when we hear organized sound, sound organized by another human being: music.[81]

Stockhausen makes the case that the very act of listening to organized sound has some form of transformative power. In the case of much of his avant-garde music, and in particular his electronic music, the nature of this transformative power focuses on the passage and perception of time. He continues:

> There is a very important observation which was made not so long ago by Viktor von Weizsäcker, a German biologist who started in medicine, which says that the traditional concept is that things are in time, where as the new concept is that time is in the things . . . the new concept tells me as a musician that every sound has its own time, as every day has its own time.[82]

This explanation would seem to fit very well with Langer's assessment of what art expresses. Stockhausen's use of sound allows the listener to reflect on the nature of time and how we perceive it. Even music that would seem to be non-referential can make an artistic statement

81 Karlheinz Stockhausen, "Four Criteria of Electronic Music," Karlheinz Stockhausen, "Four Criteria of Electronic Music," (Lecture, Oxford Union, Oxford, England, May 6th 1972), filmed by Allied Artists, London.

82 Stockhausen, "Four Criteria of Electronic Music."

about how we experience the wider world, which can be understood as a form of knowledge generation.

Much of the avant-garde music of the post-war period can be fit into to Langer's description of artistic expression. The idea of using sound to explore how we perceive the world can be cast as a kind of research, which is precisely the position that underpins both Stockhausen's lecture and Babbitt's "Who Cares if You Listen." While composers could position avant-garde music as research in this way, however, there is still something of a gap between the traditional conception of knowledge production (something that produces warranted assertions) and the expanded definition which includes ineffable knowledge.

The development of electronic music, however, allowed composers to function in both realms of knowledge production: not only could they continue to generate questions and reflection as in Langer's model, they could also contribute to the realm of Aristotle's "productive" knowledge. Developing technologies necessary to create an electronic music studio made an avenue for avant-garde composers to contribute to the development of technology that had applications in both consumer and government spheres, and many of them also had interests in Interestingly, it was during this same time that the way researchers undertook scientific and technological knowledge production was shifting as well.

F. Changing Methods of Knowledge Production: Mode 2 and Others

Historians and sociologists of science have created a number of models to explain the changing relationship between government, private industry, and universities during the latter half of the 20th century, and musicologists like Benjamin Piekut have attempted to apply some of these modeling methods (in Piekut's case, Actor-Network Theory) for music-

historical purposes.[83] For the purposes of this dissertation, the most important will be that of Mode 2 knowledge production, first proposed by Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott, and Martin Trow in *The New Production of Knowledge*. The authors make the case that in the latter half of the 20th century, research and science began transitioning from a discipline-based, broadly focused practice that was typically ensconced in university systems, to a transdisciplinary, application based processed less concerned with theory and more concerned with results.[84] Similar models, such as Etkowitz and Leydesdorff's Triple Helix model, are less dualistic in their appraisal of knowledge production, but still recognize the transformation that took place, positing a shifting relationship between government, industry, and the academy.[85] Regardless of the specifics of the model, the post-World War II economy and Cold War meant a clear shift in priorities and methods through which technology was innovated and knowledge produced.

In *The New Production of Knowledge* (*NPK*), Gibbons et al. make the case that over the course of the second half of the 20th century, there was a fundamental change in the way that knowledge was produced. Though much of their research focuses on the years leading to the close of the 20th century, they correlate the beginning of the shift at the advent of mass higher-education after the close of World War II.[86] Gibbons et al. term their different models for knowledge production as Mode 1 and Mode 2, with Mode 1 characterizing the way that knowledge and research were undertaken leading up to World War II, and Mode 2 as an ascendant model in the globalizing world. They draw the distinction between the two modes

83 See Benjamin Piekut, "Actor Networks in Music History," in *Twentieth Century Music* 11/2, 2014, 191-215.
84 Michael Gibbons, Camille Limoges, Helga Nowotny, et al. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (London: Sage Publications, 1994), 1.
85 Henry Etkowitz and Loet Leydesdorff (eds.), *Universities and the Global Knowledge Economy* (London: Casell Academic, 1997
86 Gibbons et al., 70.

as follows: they define Mode 1 as being "generated within a disciplinary, primarily cognitive context."[87] It is the method that is popularly associated with the idea of science – the idea of a lone scientist working to create theories, ensconced in a university. Any application of the theories is carried out by engineers later, as part of a separate project. *NPK* positions Mode 1 as being the typical way of producing knowledge until the middle of the 20th century.

NPK contrasts Mode 1 with Mode 2: Mode 2 knowledge is most visibly characterized by its focus on producing knowledge in the context of application, often in a way that involves solving a problem that cuts across disciplinary lines, and therefore involves numerous collaborators from different fields. The authors enumerate five qualities that they associate with Mode 2, though do make the point that all the attributes are not necessarily present in every instance of Mode 2.[88] The first attribute is the tendency focus on research that eschews the formulation of theories in favor of knowledge or technology that has immediate practical application to someone, either in industry, the government, or society at large.[89] "Application" does not necessarily mean product development, but it does suggest some type of supply and demand forces at work, though the sources of supply and the nature of demand are highly variable.[90]

The second key aspect of Mode 2 is its transdisciplinary character. "Transdiscipinarity" implies more than simply cutting across disciplinary lines. It means, among other things, that the approaches practitioners take in problem solving tend to evolve across a number of different fields, mainly because the solution tends not to arise from already existent knowledge.[91] Relatedly, the research and production methods of Mode 2 tend to be highly

87 Gibbons et al., 1.
88 Gibbons et al., 8.
89 Gibbons et al., 4.
90 Gibbons et al., 4.
91 Gibbons et al., 5.

individualized, since work takes place in the context of a specific application.[92] Transdisciplinarity is related to the third aspect of Mode 2: heterogeneity. This refers both to the skills and experience of the people who are engaged in Mode 2 research, but also to the sites where research takes place – for example, at non-university institutes, government agencies, and industrial laboratories.[93] One of the most noticable characteristics of Mode 2 is the tendency toward being less firmly institutionalized.[94] This is not to say that Mode 2 does not take place in an institutional context; rather, the lines between domains where research takes place are fluid and heterogenous. There is an accompanying diversity in sources of funding within these institutions – from private research and development funds to government grants, with each source holding different expectations and requirements.[95] The disparate sources and locations for Mode 2 knowledge production are drawn together by their common goals, hence the importance placed on application.

The fourth and fifth characteristics of Mode 2 will not be as immediately clear in the musical contexts which are the focus of this study, though they are certainly present in an indirect sense. *NPK* posits that because of Mode 2's less insulated character, it is inherently more reflexive, and has an accompanying sense of social accountability less present in Mode 1.[96] Because they are working in the context of application, Mode 2 knowledge producers are more conscious of the broader implications of their research. While this typically manifests itself in a more overt concern for the ethical implications of the applications of the technology they are producing, but also manifests itself in a broader sensitivity to public opinion. This quality can be linked with the final characteristic of Mode 2 as outlined by

92 Gibbons et al., 5.
93 Gibbons et al., 6.
94 Gibbons et al., 6.
95 Gibbons et al., 6-7.
96 Gibbons, 7.

Gibbons and company: the criteria to assess quality control. The most common way to assess competence and value in a Mode 1 context is some sort of peer review process. While this can still be (and generally is) present in Mode 2, the context of application introduces a wider range of possible criteria for assessing value, such as "Will the solution, if found, be competitive in the market?" or, "Will it be cost effective?"[97]

Though *NPK* positions Mode 1 and Mode 2 as distinct forms of knowledge production, the authors make a point that the different forms freely interact with one another. Practitioners who began in an institutional (often university) context will often become part of a team working on an application of their area of expertise, and advances which occur in the context of an applied project can fuel more theoretical, disciplinary research.[98] The discipline of computer science is a prime example of this: the authors note that while it became ensconced in the university as a discipline, computer science started as application-based research projects because of the lack of applicable, disciplinary knowledge. Now, however, computer science can be practiced in a very disciplinary way within a university context.[99]

While their discussion of knowledge production tends to focus on science and technology, Gibbons et al. spend a chapter on the humanities, and note that producers of high culture have, both historically and currently, typically existed within a system of "old-fashioned patronage."[100] As a consequence of their insulation, many of the values which characterize Mode 2 are traditionally alien to artists. This argument can certainly be made for the avant-garde instrumental music of the 1950s and 1960s, whether in America, where

97 Gibbons et al., 8.
98 Gibbons et al., 9.
99 Gibbons et al., 4.
100 Gibbons et al., 96.

modern composers became ensconced in the academy, or in Europe, where there was broader public support for the arts in the favor of government grants. Most of the knowledge produced by research into new music was strongly disciplinary, and other specialists acted as the primary arbiters of which developments had value. In general, avant-garde music does seem to fit well into the Mode 1 model.

This facile characterization is complicated, however, by US government interest in the promotion of modern art as a way of showing cultural superiority to the Soviet Union (this will be discussed more in depth shortly). The placement of avant-garde music in an entirely Mode 1 context collapses entirely at times when one considers electronic composition. Each case study I undertake shows Mode 2 characteristics to a varying degree. The reasons for this crossing over into the new paradigm for knowledge production are essentially the same as the case of computer science: the technology for electronic composition was in its infancy, and the base of knowledge necessary to have a discipline did not yet exist. In order to realize their artistic ideas, composers had to collaborate with engineers and acousticians, finding funding from either the government or private interests. These interests had their own motivations for taking part in the development of technologies necessary to realize electronic music, which ranged from development for consumer applications to more speculative research, and happened against a backdrop of the burgeoning military industrial complex in the Western sphere of influence, which complicates the assessment of these projects as purely Mode 2 creations.

NPK and the concept of Mode 2 are widely known and cited, particularly by architects of public policy.[101] The formulation is not without its critics, which often focus on two areas:

101 See Laurens Hessels and Harro van Lente, "The Mixed Blessing of Mode 2 Knowledge Production,"in *Science, Technology & Innovation Studies* 6, no. 1 (Aug 2010), 65.

the first is that Gibbons and company seem to be advocating for Mode 2 as opposed to Mode 1, "readily mixing descriptive and prescriptive language."[102] While this may be off-putting to some, in my view, the more substantial concern is the second area of criticism, which centers on the fact that Gibbons and company seem to position any given instance of knowledge production as being either Mode 1 or Mode 2, and little attention paid to possible overlap between them. Physicist and historian Dominique Pestre, for instance, notes that the book might go too far in presenting the modes as being in opposition to one another, and goes so far as to term *NPK*'s assessment as "Manichean,"[103] – an assessment that seems appropriate given the way Gibbons et al. frame the changing face of knowledge production. Pestre notes that the points of contention surrounding *NPK* are often related to the notion of continuity versus radical change.[104] Those arguing from a continuity standpoint typically dispute the existence of truly discrete forms of knowledge production:

> "Mode 1" has never existed in a pure form; modern science, as a social institution, has always been of interest to political and economic powers, it has always been produced in a variety of social spaces . . . and with various interests in mind.[105]

In spite of criticisms like these, Pestre asserts that few would argue that there haven't been large changes in the production of knowledge during the latter half of the 20th century,[106] and the *NPK* model emphasizes this point.

There are models which attempt to emphasize continuity, such as the "Triple Helix" model of Henry Etzkowitz and Loet Leydesdorff.[107] In this paradigm, the three strands of the university, the government, and industry form an interconnected helix. The relationship

102 Dominique Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading," in *Minerva* 41, no. 3 (2003), 246.
103 Pestre, 246.
104 Pestre, 245.
105 Pestre, 245.
106 Pestre, 246.
107 Terry Shinn, "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology," in *Social Studies of Science* 32, no. 4 (Aug. 2002), 600.

between the three elements change gradually over time to create different configurations of balance, and the model is designed "to be a sociological expression of what has become an increasingly knowledge-based social order."[108] It is an adaptable and subtle model, and, I believe, better takes into account more nuances in the patterns of how knowledge creation changes over time. That being said, Etzkowitz and Leydesdorff developed the model over a long period of time, and it lacks a single charter document, having "emerged gradually" from a number of smaller works.[109] The model is unapologetically multidimensional, and consequently lacks the direct punch of *NPK.* This is not to say there is more value in *NPK* – as sociologist Terry Shinn notes, "In the social sciences, abundant citation may be a better gauge of evocative language, speculation, and far-reaching generalization than of prudent measurement or careful hypothesis testing."[110] A study using the "Triple Helix" model to explore the conditions which led the the formation of the mid 20th century avant-garde would no doubt pay dividends. However, there is still much to be gained, I believe, from applying to Mode 1/Mode 2 paradigm to the development of music in the 20th century, because it helps to reveal how music relates to broader intellectual currents in ways which might otherwise escape notice.

The application of the Mode 2 model to my case studies is methodologically reversed from Latour's actor-network theory (ANT), as explained by Benjamin Piekut in his article, "Actor-Networks in Music History: Clarifications and Critiques." Piekut describes ANT as not being a theory. Rather, it is: ". . .a methodology, not a topology; it does not go looking for network-shaped things, but rather attempts to register the effects of anything that acts in a given situation, regardless of whether that actor is human, technological, discursive, or

108 Shinn, 600.
109 Shinn, 601.
110 Shinn, 602-603.

material.[111]

ANT is a flexible methodology that seeks to understand the network of actions and effects that give rise to a social situation. Broadly speaking, it is concerned with agency, action, ontology, and performance.[112] In practice, agency results when events produce "subjects that act and objects that are acted upon."[113] Humans or non-humans can all be actors, as this status is measured by effects, rather than causes. Ontology, in the context of ANT, refers to the localized nature of networks of different actors, and how they "enact realities," emphasizing individual cases rather than universals.[114] Finally, performance refers to the actual enacting of relations between members of the network.[115] ANT analysts attempt to fully understand the web of actors that gives rise to a given situation. The Mode 2 paradigm is a model that is used to describe specific situations involving knowledge production, and so is both more narrowly focused and more theory-oriented than ANT. However, it too is concerned with actors in a given collaborative situation, and so is not wholly in conflict with it. A systematic application of ANT methodology to my case studies could well yield interesting and complementary insights about their respective situations.

As a model for comprehensively describing historical shifts in knowledge production and the way they happen through time, *NPK* undoubtedly oversimplifies. However, it does a very good job of describing characteristics of a particular mode of knowledge production which arose during the second half of the 20th century, and because many of the characteristics of this model match well with the development of electronic music studios in the 1950s, it serves as an appropriate model to use for this particular study. These characteristics become

111 Piekut, 193.
112 Piekut, 194.
113 Piekut, 194.
114 Piekut, 199.
115 Piekut, 201.

particularly apparent when examined in the context of the increasingly institutionalized and inward-looking acoustic avant-garde – while avant-garde musicians who took part in the development of these studios were still concerned with producing music in a similar vein to their acoustic works, the requirements for creating an electronic music studio meant that wider collaborations had to be formed, and those collaborators had their own interests and goals in their participation in developing the technologies necessary for the projects. While many of these collaborators represented various industrial or academic concerns, it was often indirectly funded or supported by US government interests, who were primarily concerned with containing the Soviet Union, and establishing both technological and cultural dominance over them on the world stage.

G. Introducing the Case Studies

The question of how large-scale government support of the avant-garde, whether intentional or as a collateral effect of larger cultural funding efforts, interacts with the framework of Mode 2 knowledge is important, but a difficult one to answer. Gibbons et al. are not particularly concerned with situating the rise of Mode 2 in a historical context (beyond placing the beginning of its ascendancy in the middle of the 20th century), being more concerned with describing the current state of scientific knowledge production, and how that relates more broadly to society at large. Other writers have attempted to position Mode 2's historical and political development, notably Dominique Pestre, but there is no clear consensus among historians and sociologists of science where and when the phenomenon of Mode 2 first arose. Government support of the arts during the Cold War is certainly a collaborative relationship, but it is difficult to categorize the effort as application-based or transdisciplinary in any meaningful way.

This government patronage combined with the aforementioned tendency for non-scientific disciplines to become increasingly institutionalized within an academic context – perhaps swept along with the trend in the sciences towards institutionally-based, government-funded research projects in the sciences, which occurred as part of the growth of the military-industrial complex. Within the arts, and particularly music, there were much more limited applications for outside collaboration, so rather than function as a base from which specialists and technicians were trained and funneled into projects with industrial or military applications, they became increasingly insular. Avant-garde music could be useful to the U.S. government inasmuch as it represented a degree of cultural achievement in a style to which the Soviets were opposed, and thus fostering a taste for it among intellectuals helped in the fight to keep them from embracing communism. But this is fundamentally a fairly narrow application. "Research" in most avant-garde music has been marked by a strongly inward, disciplinary focus that did not have much cause to interact with other disciplines. The idea that some fields used their place in the university system as a springboard to wider corporate or government collaboration, while other fields concentrated on used their ensconced status to focus on narrow, disciplinary is not contradictory – in *Rethinking Science*, her followup to *NPK*, Helga Nowotny notes that while Mode 1 knowledge has a strong bastion in the university system, it is not contradictory that Mode 2 finds a place within the academy as well. She writes, "far from being inconsistent with the idea of Mode 2, the advance of the university as a place where contextualized and distributed knowledge production takes place, can itself be regarded as a component . . . of that contextualization and its distribution."[116]

The exact nature of the interplay between institutionalized knowledge production and

116 Helga Nowotny, Peter Scott, and Michael Gibbons, *Rethinking Science: Knowledge and the Public in an Age of Uncertainty* (Malden: Blackwell Publishers, 2001), 80.

larger collaborative applications is complicated, and varies between disciplines. In some cases, experts from a variety of fields must work together to create a specific product or new technology (Gibbons et al. give the example of developing hypersonic engines.) In this example, the different experts are unified in the ultimate purpose of the project. This is not necessarily the nature of every case of collaboration, and I believe that the particulars for how electronic avant-garde music might exhibit Mode 2 characteristics are crucially different.

Early electronic music necessarily exhibited Mode 2 characteristics, since they were fundamentally a collaborative, application-based endeavor. Some organizations which created studios had a strictly musical goal, like Pierre Schaeffer's *Groupe de Recherche de Musique Concrète.* Many other early electronic music projects, however, had a nominal extra-musical purpose as well. This might take the form of more broadly conceived acoustical research, as was the case in the WDR Cologne studio. In the case of this studio, Werner Meyer-Eppler (a phonetics specialist) paired with composers Robert Beyer and Herbert Eimert to develop their pioneering electronic music studio, while at the same time studying the application of technology to phonetics.[117] It is unlikely the studio would have been realized without the involvement and input of all three men, but while this case has the Mode 2 characteristic of collaboration across fields, it lacks the application-based focus of Mode 2 as Gibbons et al. describe it.

The case studies I choose to highlight have clearer ties to the Mode 2 paradigm. Each studio or project is the result of collaboration between a backing private corporate interest and a composer, or composers. Each composer was a key figure in modernist or avant-garde

117 Peter Manning, *Electronic and Computer Music* (New York: Oxford University Press, 2013), 80.

music in their respective countries, and importantly, those countries were all under the direct political and economic influence of the United States. Since Germany and Japan were defeated axis powers, the U.S. government played a direct role in the administration of their post-war governments, and exerted extensive influence in the cultural sphere. Though there are broad similarities, exactly how the forces of government, private industry, and academia interacted to create a backdrop for the composition of avant-garde music varied between each country. I explore these three relatively narrow cases within this broader paradigm to understand these relationships, and how they might affect each composer. It is not my intention to argue that composers are simply vessels through which zeitgeist takes musical form. Rather, composers are affected by and react to their circumstances, and the musical result will be shaped by factors outside of the individual's creative process. As in the case of any collaboration, success, in the eyes of each individual participant, can vary greatly. My case studies show a wide range of outcomes for the composers involved, but in each case the musical results from their electroacoustic work prove to be highly relevant for them, artistically.

I believe that the required collaborations between composers and other actors in the creation of technologies and techniques necessary for new works of electronic music means that the electronic composer's relationship to knowledge production offers more a more natural route into Mode 2 than the path of the primarily acoustic composer. There is a wider scope to their activities, which means that even if their primary concern is composition, they are far more likely to interact with people outside of their discipline. While the cases in this study focus on the beginnings of the modern electronic avant-garde, the precedent that they set for extra musical significance in the form of new technologies and applications extends

through the history of electronic music. For example, John Chowning's development of FM synthesis and Stanford's subsequent licensing of the technique to Yamaha is a clear case of a trained composer's technical innovation having a wider effect on society than is typical for the far more inward-looking innovations of acoustic avant-garde composers. Turning back to the period of my study, I believe that though my scope is narrow, it will nevertheless help to illuminate an important aspect of the era's cultural zeitgeist.

1. Babbitt and the RCA Synthesizer

My first study revolves around Milton Babbitt, the Columbia-Princeton Electronic Music Studio, and the RCA mark II synthesizer. The synthesizer was highly significant for Babbitt's development of his particular strain of serialism, but was ultimately a commercial failure for RCA, largely because of the divergent goals of the participants involved. RCA Engineers Harry Olson and Herbert Belar built the synthesizer as part of their research in the electronic synthesis and automation of both performance and composition, with projected use for, among other things, composing popular music for commercials and radio.[118] For a variety of reasons, the synthesizer was not well suited to that application (this will be further explored in the chapter). If Olson and Belar sought to create a synthesizer that could be mass produced, Milton Babbitt sought to direct the development further toward the type of music that he was personally interested in creating. This showcases a potential complication with Mode 2 knowledge production that seems a particular risk in cases that involve an artistic component, like that of electronic music. The artist's goals are likely to be highly individualized, while the research and development goals for the other parties are likely to extend beyond one individual's artistic vision. Giving Babbitt's vision such preeminence

118 Thom Holmes, Electronic and Experimental Music, 3rd Edition (New York: Routledge), 2008, 94.

ultimately limited the commercial viability of the device. While the creation of the RCA Mark II synthesizer has many Mode 2 characteristics, the seemingly divergent goals of the participants involved in the collaboration meant that the end product did not enjoy the unity of vision that other Mode 2 efforts might enjoy.

2. Riedl, Kagel, and the Siemens Studio for Electronic Music

This case can be contrasted with the formation of the Siemens Studio for Electronic Music. Siemens assembled a team of engineers and acousticians to create a studio whose sole inital purpose was the creation of music for an important promotional film. They employed Anton Riedl as a consulting composer during the development of the studio equipment. Subsequently, Siemens used the studio not only to test new audio and visual equipment, but also to compose electronic music for industrial commissions. As a side effect of this activity, it was an exceptionally well-equipped facility, and a number of composers, including Ernst Krenek and Mauricio Kagel, composed works there. The Siemens studio represents a relatively pure case of the Mode 2 paradigm, and one that seems to have accomplished all of Siemens's goals. It also had important artistic ramifications for Kagel, who created an important electronic work there: *Antithese*. This piece represented a coalescing of themes he was working with in his music at the time: his idea of "instrumental theater" (where the performative act drew attention to itself as conspicuously part of the musical work), the melding of *concrète* and *elektronische* techniques in his composition, and the preoccupation with non-aleatoric indeterminacy, in schemes that might be considered in a similar vein to Umberto Eco's "open work" concept. For Siemens, the studio was a piece in their efforts at post-war redefinition. For Kagel and other composers, it served as a state-of-the-art facility for electronic composition that was also relatively non-partisan, at a time when the was

personal and professional division among many of the leading figures in the avant-garde.

3. Takemitsu, Jikken Kobo, and Sony

The role of early electronic composition in the Japanese avant-garde had some similarities with that of Germany, but important differences as well. While composers in both countries were using the new medium to explore and extend the palette of sound available to them, the Japanese composers approached experiments with sound from a slightly different standpoint. Composers like Makoto Moroi began experiments in electronic music with a serial framework,but many soon turned from serialism in favor of an approach that attempted to combined the principles of Japanese traditional music with western ideas, creating a distinctly Japanese electronic music.[119] The artist collective *Jikken Kobo*, of which Takemitsu was a member, was formed by an independent group of artists, musicians, dancers, and dramatists, and worked collaboratively to explore modern art in an intentionally non-institutional setting. Members worked with the company that would become Sony, gaining access to performance venues and recording technology in exchange for testing perspective consumer products. Sony even set up an electronic music studio at the Sôgetsu Art Center,[120] which many Japanese composers, including Takemitsu, used to realize electronic music and *musique concrète.*For these composers, the technological advancement (brought about through a collaborative development process) opened an avenue to use traditional ideas as inspiration for creating new works, ultimately helping to establish a uniquely Japanese vision of avant-garde composition. In return, Sony got testing and promotional material for many of their earliest electronics: products which would launch the corporation as a technology

119 Emanuelle Loubet, Curtis Roads, and Brigitte Robindoré, "The Beginnings of Electronic Music in Japan, with a Focus on the NHK Studio: the 1950s and 1960s, in *The Computer Music Journal* 21 vol. 4, 16.
120 Holmes, 107.

powerhouse.

H. Electroacoustic Music Analysis: Methodologies from the Literature

In order to more fully understand the artistic significance of my case studies, I will be including In my investigation of individual compositions, I will be drawing on a number of analytical models for my observations. Works of electroacoustic music offer a number of specific challenges to analysis: there is rarely a score, and even when the composer does supply one, the degree to which the score represents the full breadth of the piece is quite variable. Consequently, the methods by which analysts use to better understand these works tends to be highly individual to the work in question (examples of this will be discussed shortly). My analyses follow this pattern. In spite of this tendency toward ad-hoc analysis, though, there are techniques that are broadly used: most notably that of spectrographic analysis.

One of the first publications to make wide use of sonograms was Robert Cogan's *New Images of Musical Sound.*[121] Cogan's work is groundbreaking not only in that he makes extensive use of sonograms as an aid to analysis, but also in that he the uses the technology to analyze both electroacoustic and acoustic music. From the outset, it is clear he intends to use the sonograms to shed light on what was (and arguably, still is) an under-explored realm of music analysis: the domain of timbre, saying "The very essence of a musical culture, epoch, or styles is embodied in its unique sound . . . Only now, through a new synthesis of scientific and musical analysis, can we begin to probe the sonic enigma."[122] Cogan goes on to introduce the reader to how to read a sonogram, and covers basic information such as the physical explanation for timbre and the concept of vocal formants. Much of the book focuses

121 Robert Cogan, *New Images of Musical Sound* (Cambridge: Harvard University Press, 1984).
122 Cogan, 1.

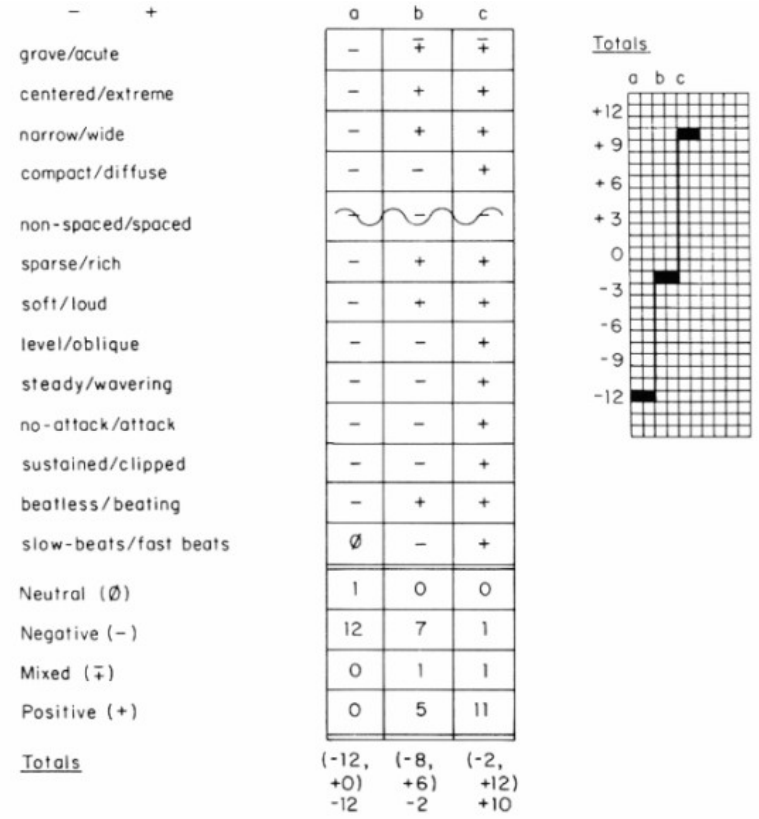
on short analyses, wide-ranging in scope, and seemingly meant more to suggest the possibilities for spectral investigation than to give exhaustive analyses of individual works. For example, he compares the spectra of Beethoven's Piano Sonata op.109 played on two different instruments, a fortepiano of Beethoven's period and a modern grand, noting that the fortepiano gives a timbral richness lacking in the grand.[123] He also investigates timbre through the spectra of everything from Tibetan chants to Debussy's *Nuages* to Babbitt's *Ensembles for Synthesizer.*

Cogan's purpose behind these wide-ranging investigations is the establishment of a working theory for analyzing tone-color.[124] Cogan makes a number of relevant observations here: he gives thirteen distinct sonic features, listed as a table of oppositions (an example of which can be seen in fig. 1.1). Cogan's oppositions, taken together, describe the trajectory of the sonogram of a given section. To avoid having these observations be a simple exercise in labelling, Cogan attempts to categorize the sonic features in terms of their positive and negative energy state: for example, he writes that registrally *grave* (lower frequency) is negative, while its opposite, *acute* is positive. *Narrow* spectra (low internal contrast) is negative, while *wide* is positive. Over the course of a given section, Cogan sums the positives and negative to give a holistic view of how the passage's energy state develops.[125]

Though I am not totally convinced of the viability of equating the type of sonic energy represented by each pair of oppositions, Cogan raises intriguing possibilities with his theory. Even if his method of amalgamating the pairs into a single numerical value has the potential to be problematic, his listing of opposing pairs gives the analyst characteristics and terminology to use when trying to make sense of a sonogram's meaning.

123 Cogan, 49-52.
124 Cogan, 123-125.
125 Cogan, 126-128.

Fig 1.1 – Cogan's Table of Oppositions from Berg, *Wozzeck,* III, Sc 2, mm. 109-116



− +	a	b	c
grave/acute	−	∓	∓
centered/extreme	−	+	+
narrow/wide	−	+	+
compact/diffuse	−	−	+
non-spaced/spaced	~	−	~
sparse/rich	−	+	+
soft/loud	−	+	+
level/oblique	−	−	+
steady/wavering	−	−	+
no-attack/attack	−	−	+
sustained/clipped	−	−	+
beatless/beating	−	+	+
slow-beats/fast beats	Ø	−	+
Neutral (Ø)	1	0	0
Negative (−)	12	7	1
Mixed (∓)	0	1	1
Positive (+)	0	5	11
Totals	(-12, +0) -12	(-8, +6) -2	(-2, +12) +10

The next volume of specific use to my project is *Electroacoustic Music: Analytical Perspectives,* edited by Thomas Licata. This is a collection of nine analyses from different authors. Each author is concerned only with analyzing one piece, so there is no attempt made to create a universal system for analyzing electroacoustic music. The most useful analyses in the volume for my study cite Cogan as an influence, and adapt his approach to spectral analysis to their own needs. This includes Thomas DeLio's "*Diamporphoses* by Iannis Xenakis," Thomas Licata's "Luigi Nono's *Omaggio a Emilio Vedova,"* and Kristian Twombly's "Oppositional Dialectics in Joji Yuasa's *The Sea Darkens*."

In all of these studies, the authors use sonograms in a highly individualized application to

explore to point to specific gestures and understand large-scale form. While none of them make use of Cogan's energy-state-totals model, they all use aspects of his terminology. DeLio, for instance, describes *Diamorphoses by* referencing the development and spread of frequency density, essentially melding Cogan's oppositions of compact/diffuse, sparse/rich, and space/non-spaced to show how these characteristics develop and make the case that the changing frequency regions define a tripartite form.[126]

Licata, in his analysis of Nono's *Omaggio a Emilio Vedova,* uses a combination of sonograms and amplitude graphs to similarly explain the form as tripartite. He also makes use of an adapted set of Cogan's oppositions: the compact/diffuse observation of spectral character, but also a description of amplitude (low/high), and a description of sound types used (sustained/short).[127] Licata concludes that the form of the work is defined by a mixture of these elements that gives way to separation: part one has the spectral character moving from diffuse to compact, the amplitude moving from low to high, and the sound types moving from a mixture of sustain/short moving to a separation of sustained and short; section two then concentrates on diffuse spectra, low amplitudes, and sustained sounds; finally, section three moves to compact spectra, high amplitudes, and short sounds.[128] However, he also notes that the piece can be grouped into two, with section one forming the first part, and sections two and three the second, because of the dramatic change in character between the first and second sections, and the less dramatic change between the second and third. This simultaneity creates a multilayered tension that drives the composition's drama.[129] While Licata could have described this without the use of sonograms, Cogan's techniques and

126 Thomas DeLio, "*Diamorphoses* by Iannis Xenakis," in *Electroacoustic Music*, ed. Thomas Licata (Westport: Greenwood Press, 2002), 44-50.
127 Licata, 82.
128 Licata, 86.
129 Licata, 86-88.

verbiage help to structure his observations in a way that makes the seeming intangibility of purely electroacoustic music less daunting.

The last analysis of specific significance to me in *Electroacoustic Music: Analytical Perspectives,* is Kristian Twombly's analysis of Joji Yuasa's *The Sea Darkens.* Joji Yuasa was a member of the same *Jikken Kobo* art-collective as Toru Takemitsu, whose work, *Water Music*, I will be analyzing in chapter 4. Though *The Sea Darkens* is not from the *Jikken Kobo* period, being composed in 1987, Twombly's analysis is still illuminating, as Yuasa's piece has some similarities with *Water Music*. They are both processed *concrète* sound, rather than computer generated sound. Yuasa's work uses spoken words passed through different filters to create a good deal of his sound material for the work.[130] Not only does the sonogram allow Twombly to describe the filters used in a given section, it gives an easy way to parse the temporal framework of the piece: an examination of the sonogram reveals a structure very much influenced by the Golden Section and Inverse Golden Section.[131] Having a physical representation of the piece to measure makes this far more apparent than trying to parse it aurally, and Twombly is able to convincingly explain the work's form by showing how linguistic and filter shifts occur at times corollated to these Golden Section measurements.

Because of the often highly individual, self-contained nature of electroacoustic compositions, it is difficult to formulate a systematic analytical scheme. Attempts like Cogan's, while laudable, can risk homogenizing sonic characteristics across compositions in the quest to impose an overarching order. However, a more narrow application of his ideas can be rewarding. Employing spectrographic analysis, the analyst can at least take a wide-

130 Twombly, 219.
131 Twombly, 229.

angle view of a work, examining a representation of it all at once in a way that impossible aurally. Such an examination frequently reveals aspects of the work that were theretofore inaccessible, and is a powerful tool for understanding the piece's timbral characteristics, as well as how it is structured formally.

I will carry out analyses that use spectrographic analysis in two of my three studies; in the chapter focusing on Babbitt, my main analysis focuses on *Sounds and Words*, an acoustic piece written during Babbitt's initial experimentation with the RCA synthesizer. Though I do not make use of spectrograms in that chapter, I undertake an analysis of a short passage from a recording of the work, and provide an annotated amplitude/time representation of the passage. As most of what I refer to in the work is notated in the score, spectrographic analysis was not necessary. Much of my analysis focuses on the extreme precision required to successfully represent the work's serial architecture, and Babbitt is able to use the precision afforded by the RCA synthesizer in future works. In the chapter on Kagel and the Siemens studio, I use spectrograms of the electronic score of *Antithese* to show how sound material is is structured around passages of connection and disconnection. This dichotomy extends to the printed dramatic portion of the work, where an actor executes actions that will, at times, correspond to the sound material, and at times not. Spectrographic analysis helps to show the larger structure of the work, and helps to shed light on a piece that tends to frustrate attempts at analysis. Finally, I utilize spectrograms of Takemitsu's *Water Music* in the chapter focusing Takemitsu and Jikken Kobo. *Water Music* uses processed natural sounds that emphasizes the character of individual sound events. Spectrographic analysis allows for a better understanding of the type of subtle motivic development Takemtisu utilizes to ensure a piece that is aurally coherent, yet seems to eschew large-scale formal development.

In each of these three case studies, it is my goal to show how societal trends can concretely affect the circumstances and practice of composition. The place of research within an early Cold War context and the conception of art as a kind of research or form of knowledge production helped to shape the structures in which composers operated. As the scope of this project is somewhat narrow, being only three case studies situated within the same ten year time period (1955-1965), I cannot hope to make a universal statement about how these trends tend to affect composers' practice, or, for that matter how composers' practice can affect broad societal trends. However, I believe this study does show trends within a very limited timeframe, and these patterns are useful in understanding how the avant-garde of this era, a movement whose adherents often prided themselves on their non-referential music, functioned within the broader society which surrounded it. Furthermore, I believe my analyses of some of the musical results of composers' use of technologies, developed in larger collaborative efforts, show how broader trends can have localized implications, filtering down to the level of affecting artistic movements and works.

II: Milton Babbitt and the RCA Mark II Synthesizer

A: The Development of the RCA Synthesizers

The story of Milton Babbitt and the RCA synthesizers is unique among my case studies in that it constitutes a collaboration with many Mode 2 characteristics that nonetheless serves, almost entirely, a Mode 1 application. Consequently, it is useful as an example of modes of knowledge production in transition, reflecting some of the aspects of Mode 2 while still embodying Mode 1 in its execution. It shows the possibility that even collaborative, application-focused efforts might ultimately serve (and shape) the interests of only one of the parties. Though the synthesizer was certainly a technical achievement for RCA, it was a commercial loss. The real benefactor was Babbitt, who secured for himself what amounted to a personal composition tool – one that would have lasting influence on his own theory and practice.

The initial vision for the machine's purpose is not entirely clear, and the accounts given by the synthesizer's designers, RCA engineers Harry F. Olson and Herbert Belar,[132] are somewhat vague. Olson, for his part, wrote that the purpose of the machine was "to investigate the creation and control of electronic sounds."[133] This could mean just about anything, but there are a number of possible short term goals for why RCA opted to initially sponsor the synthesizer project. Peter Manning surmises that the impetus for RCA to pursue the project was that:

> The company was sufficiently far-sighted to realize that such investigations might lead to useful advances not only in communication theory, but also in areas of acoustical research, and accordingly gave them official support in their ventures.[134]

132 Manning, 83.
133 Olson, quoted in Robin Maconie, "Care to Listen: Milton Babbitt and Information Science in the 1950s," in *Tempo* 65, 258 (October 2011), 32.
134 Manning, 83.

Though ultimately speculative, this is reasonable. Robin Maconie notes the confusion created by the ambiguities surrounding the synthesizer's creation, which revolve around the role that composers like Milton Babbitt and Vladimir Ussachevsky played in the project's development, as well as the precise purpose for which the machines were created.[135] Conflicting information has led to widespread misconceptions about the synthesizer: for example, Robert Morris writes that the synthesizer, "was originally developed at Bell Labs to synthesize speech,"[136] perhaps conflating the synthesizer with the vocoder. That said, this perceived tie to speech synthesis is perhaps not so fanciful. Maconie believes that the long term goals for the project may well have been related to information technology research, with speech synthesis applications. He writes that the sound perimeters specifiable for the RCA synthesizer (frequency, intensity, growth, duration, decay, portamento, timbre, and vibrato) are very similar to the non-onset characteristics of speech as described by information scientist Andre Moles (these being periodic, steady state, reverberant, fricative, crescendo, decrescendo, and vibrato). The original reason for those linguistic categories was to "arrive at a universal repertoire of speech sounds of equal application to music and speech,"[137] which has practical goals for speech recognition, robotics, and acoustic pattern recognition. While these were not the stated goals for the synthesizer, Maconie writes:

> There is every reason to suppose that the RCA Mark I synthesizer was devised, funded, and authorized as a teaching and research package with the aim of stimulating expertise and product development in areas relating to intelligence information storage, encryption, and delivery.[138]

This would be a longer-range vision that is not backed up, so far as I know, with any

135 Maconie, 31.
136 Robert Morris, “Listening to Milton Babbitt's Electronic Music: The Medium and the Message,” in *Perspectives of New Music* 35, no. 2 (Summer, 1997), 87.
137 Maconie, 35.
138 Maconie, 31.

documentary evidence, plausible though it may be.

Maconie ultimately settles on ascribing a more practical vision for the machine, writing that it was designed to compose light music for the movie industry.[139] It is certainly conceivable that RCA would be interested in supplying the movie producers with an easy way to create background music and subvert costly union wages. RCA was presumably open to any possible application for their machine, though the inclusion of a vibrato generator in the original design suggests that at least part of Belar and Olson's original intention for the machine was to imitate acoustic instruments, rather than create wholly new timbres.

Belar and Olson's synthesizer project was preceded by a machine designed to automatically compose music in the style of a given composer, based on probabilistic score analysis.[140] The engineers had limited, if any, musical training, and consequently their understanding of the musical parameters necessary to create even a simple composition was insufficient. The system of probabilities was based on a statistical analysis of pitch sequences in twelve Stephen Foster folk songs.[141] Manning's assessment paints a grim picture:

> On the simplest level of analysis it must be clear that the composing machine was incapable of synthesizing even a songlike structure, let alone a song in the style of a particular composer. The probability mechanism, working from note to note, could not accommodate such basic considerations as tonality and the strophic structure of phrases.[142]

As non-musicians, Olson and Belar could scarcely have hoped to have done better at creating an automated composition machine. While they had they electrical and engineering knowledge, they simply lacked the musical expertise needed to understand what would be necessary to create a capable device. Their next project neatly sidestepped the issues the had

139 Maconie, 31.
140 Manning, 83.
141 Manning, 84.
142 Manning, 88.

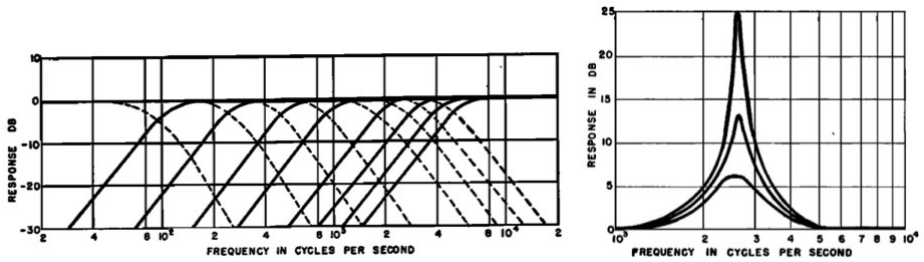
with their composition apparatus by requiring a technician to operate it, while still allowing the engineers an avenue to use what they learned about electronic sound synthesis: the first RCA synthesizer.

The first iteration of the device (the Mark I), featured two output channels, which drew from a shared selection of source sounds, and a sound bank consisting of twelve tuning fork oscillators, which produced sine waves, as well as a white noise generator. The tuning fork oscillators only generated tones between F#5 and F6, so an octaver was necessary to generate other registers.[143] The sine wave could be converted into either a square or sawtooth wave. The composer could then specify attack envelopes, sustain, and decay, as well as vibrato and portamento characteristics.

To create different timbres, the synthesizer utilized subtractive synthesis, meaning that a source wave (generally a harmonically rich waveform like a sawtooth) is passed through high and low pass filters (which in tandem, function as a bandpass filter), stripping out certain frequencies, and using resonator chains to emphasize others (see fig. 2.1 for Belar and Olson's graphs of the frequency and resonator responses). Combined with the different possible attack envelopes, the machine was capable of a very large number of possible timbres. There are a number of advantages to this method of synthesis: one can make a great variety of different sounds using relatively few tone-generating oscillators and a few filters. As Babbitt notes, there are a tremendous variety timbral possibilities, when the different envelope settings of the machine are combined with the different filter settings.[144]

143 Manning, 90.
144 Milton Babbitt, "An Introduction to the R.C.A. Music Synthesizer," in *Journal of Music Theory* 8, no.2 (Winter, 1964), 254.

Figure 2.1 – Frequency Response of RCA Synthesizer Filters and Resonators[145]



Filter Response | Resonator Response

In practice, however, the synthesizer's capabilities in the timbral realm were somewhat limited, for a few reasons. First, as Manning notes, the filters and resonators were controlled by a manually operated switch, which could not automatically track the incoming signal, and thus meant one could not set a consistent shape for a sequence of different pitches.[146] Secondly, and most crucially, the timbral settings could not create timbral variations quickly enough to emulate acoustic instruments (a stated possibility in Olson and Belar's introduction to the machine).[147] This inadequacy stemmed from both the synthesis hardware and the technicians' modeling. Jean Claude Risset notes the fundamental problem of early attempts at this type of synthesis:

> ...the pioneers of electronic music failed to imitate realistically the sounds of traditional instruments. This failure had been ascribed to the inadequacy of Fourier analysis. But the early analyses were not time-varying, so the failure was due rather to the fact that the imitations were derived from an oversimplified model of instrumental sounds. This model comprised a steady state with an invariant spectrum presumed to be characteristic of the instrumental timbre. Some acousticians (Stumpf 1926; Leipp 1971) and tape musicians (Schaeffer 1966) were not as naive in this respect; the inadequacy of such a model could easily be demonstrated by simple manipulations such as tape reversal. However, it was not easy to implement more elaborate synthesis models.[148]

145 Taken from Harry Olson and Herbert Belar, "Electronic Music Synthesizer," in *The Journal of the Acoustical Society of America* 27, no. 3 (May, 1955), 605-606.

146 Manning, 92.

147 "Thus it will be seen that it is possible to generate any tone produced by a voice or a musical instrument by employing an electronic system." (Olson and Belar, 595).

148 Jean Claude Risset, "Digital Techniques and Sound Structure in Music," in *Composers and the Computer*,

The timbre of an instrument changes over time, from attack, to sustain, to decay. The input system made it very difficult to do this, and at any rate, the time scale the machine was capable of was simply inadequate. Inputting all the changing timbre parameters for each sound event, even in the time scale in which the machine functioned, was a tremendously laborious process. Babbitt, for his part, downplays these difficulties, describing the process of using the synthesizer to change a single tone's timbre: "Certainly, this is not easy, but it is fascinating; can anyone assert the latter of the copying of score and parts, the rehearsing of recalcitrant performers?"[149] He is, unsurprisingly, mum on the allure of spending hours entering this data for the shifting timbre of every sound event in painstaking binary code.

Input was facilitated by a punched paper tape roll. The composer (or technician) entered binary commands controlling five parameters: frequency, octave, envelope, timbre, and volume.[150] Seen below (fig. 2.2) is a sample, supplied by Olson and Belar, of "Home Sweet Home." It's worth noting that the technician often employed alternating channels in crafting a single line, which Babbitt notes was "not only to avoid coding ambiguities but to afford subtle control of connection by – primarily – overlapping the decay of one event with the growth of the succeeding event."[151] As each hole had to be manually inputted, one can understand that coding this machine was a laborious process.

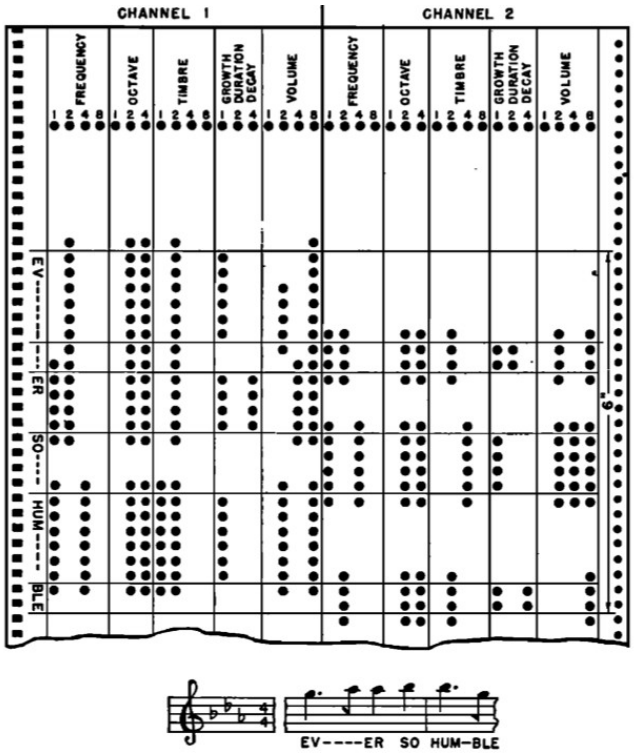
ed. Roads (Los Altos, CA: W. Kaufmann, 1985), 118.

149 Babbitt, "An Introduction to the R.C.A. Music Synthesizer," 262.

150 Holmes, 146.

151 Babbitt, "An Introduction to the R.C.A. Music Synthesizer," 258.

Figure 2.2 – Sample Paper Tape Code (and Notation) for the RCA Synthesizer[152]



The resultant passage could then be recorded onto a record by a built in disc-cutting lathe. Manning surmises that the reason for the inclusion of the lathe and disc system over a tape is that RCA, being invested heavily in gramophones, had an interest in trying to find new applications for the technology, rather than exploring the more suitable tape technology (which was, incidentally, typically undervalued by the recording industry at the time).[153] Duration and tempo were a product of this rather idiosyncratic input system: the paper tape's input mechanism was tied to a motor with a variable-speed drive, which was linked to the lathe.[154] The motor could transport the paper tape at anywhere from two to eight inches per second, which, crucially, meant that musical time was a product inches of tape, rather than of

152 Taken from Olson and Belar, 607.
153 Manning, 94.
154 Manning 93.

inputing a recurring metrical and tempo pattern.[155] This system was not without significant drawbacks: while one could adjust the total tempo of a passage by changing the playback speed, if one sought to adjust the tempo of a passage relative to the rest of the work, the entire piece would have to be recoded. Additionally, even at the lowest speed, the length of a role of the input paper meant the synthesizer was only capable of producing four minutes of music.[156] The combination of the disc-system and the limited ability to realize longer works meant that if a composer sought to assemble a more substantial piece, they would have to record from completed lacquer discs onto tape, which required, as Manning notes, "considerable manual dexterity to ensure smooth joints."[157]

It was the Mark I which captured the attention of Otto Luening and Vladimir Ussachevsky, who had collaborated in creating tape-music in the early 1950s at the Columbia Tape Music Center.[158] After some success and attention from the general public for their tape compositions (even making a live appearance on NBC's *Today Show*),[159] they received a grant from the Rockefeller Foundation to study electronic music in Europe, embarking on their travels in 1955.[160] They used the grant to tour Schaeffer's GRM facilities, as well as those of Eimert at WDR Cologne, but were not totally convinced by either studio's approach. The men were putting together an idea of what would be needed for an electronic music studio in the United States when they became aware of RCA's synthesizer.[161]

They soon found that Babbitt (at Princeton) was also interested in the synthesizer, and worked together experimenting with the machine for several years. From 1957-8, Luening

155 Manning, 94.
156 Holmes, 146.
157 Manning, 95.
158 Holmes, 91.
159 Holmes, 92.
160 Holmes, 92.
161 Holmes 93.

and Ussachevsky submitted a number of proposals to the Rockefeller Foundation, lobbying for the creation of various organizations to sponsor electronic Music.[162] The eventual result was the Foundation's offer of a joint grant of $175,000 to the two universities over a five-year period.[163] Babbitt, in particular, logged many hours on the synthesizer, and worked closely with the RCA engineers to improve it, altering the output from disc to tape, expanding the number of oscillators, and installing a second paper-tape input for the machine. The result of this collaboration was the Mark II version of the synthesizer, which was delivered to Princeton in 1959.[164] While the capabilities of the machine were certainly expanded by the additions, most of the fundamental aspects of using the device were unchanged. The labor-intensive, rather clunky punch-card interface remained the only option for input. Equally important, the duration system was still based on the intake rate of paper-tape.

The agreement to create (and lease) the Mark II synthesizer is where the story gets somewhat murky; we know that RCA leased the updated model of the synthesizer, for a nominal fee, to the Columbia-Princeton Center in what amounted to a permanent loan. Milton Babbitt became the primary point of contact here; neither Luening nor Ussachevsky seem to have been particularly taken with the machine. In his account of how each of the three men used it, Ussachevsky wrote:

162 Manning, 83.
163 Maconie, 32.
164 Manning, 95.

> Once in the presence of the awesome RCA machine we explored it – but each in his own way. Further differences emerged within each session. Otto, in the brief time he had, focused on realization of short passages of electronic materials, destined for later use within the environment of the electronic (pre-synthesizer) studio. For me, the transition from hand manipulation of controls to that of coded instruction never brought me into a state of intimacy with the RCA Synthesizer. . . Milton treated the machine systematically as a tool, which eventually allowed him to put into practice some long-formulated principles. Assured of the pitch accuracy, he gained precise control over the intricate relationship among the parameters of time, dynamics, and timbre and proceeded to become a supreme master of the synthesizer.[165]

Babbitt appears to be the only one who spent sufficient time with the machine to master it, and he had a very specific goal in doing so: to further develop his theories regarding serializing sound parameters – an aim notable in its Mode 1 orientation.

In an audio statement, Babbitt claims that RCA gave them the synthesizer because they had no other use for it.[166] That makes a certain amount of sense, given the extremely friendly terms of their lease. However, it seems peculiar that RCA would have worked so closely with him to build a new machine with the changes he specified if it was a dead-end technology that they were "dumping" (to use Babbitt's phrasing). Were this the case, surely they would have given the Electronic Music Center the original synthesizer rather than build a new one with updated features. Perhaps they had hopes that updating some of the features would make the machine more broadly marketable, but the changes they carried out had no hope if increasing the device's marketability. As Maconie notes: "Babbitt's role in modifying the Mark I design clearly had the desired effect of making the Mark II more difficult to work with, less susceptible to intuitive manipulation, and by way of a corollary, establishing an aesthetic of pre-control on any music produced.[167]"

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165 Vladimir Ussachevsky, "A Bit of History and a Salute to Milton," in *Perspectives of New Music* 14/15 (Spring/Summer, Fall/Winter 1976), 44.

166 Kevin Meredith, "The Story of the RCA Synthesizer," Youtube video, 7:13, posted Dec. 16th, 2012, https://www.youtube.com/watch?v=rgN_VzEIZ1I.

167 Maconie, 33.

In making Babbitt their primary composer-collaborator (whose compositional interests did not have much popular appeal, and hewed closely to the Mode 1 model of insular theoretical research), RCA unwittingly guaranteed that the functional application for this device was narrow and difficult to market. Had they consulted with other composers, perhaps including those more oriented toward a popular audience,[168] they might well have come up with alterations to the machine's input that could have allowed for a more intuitive interface, or allowed some measure of automation so that it was unnecessary to spend tedious hours programming in parameters that often would not change for the duration of a tune in most popular applications (the timbre, for instance, or in some cases, attack envelopes). Instead, they created what was, in essence, a composition tool geared solely for Milton Babbitt and composers like him. From RCA's perspective, the development and collaboration involved in creating machine can only be regarded as a loss. However, it proved important for Babbitt, particularly in his development of the time-point system and in his treatment of timbre. It is worth examining a few pieces he composed during this period, both for acoustic instruments and for the synthesizer, in order to appreciate the impact it made on Babbitt's personal compositional practice, and how this relates to the RCA Mark II synthesizer's example as a deformation of the Mode 2 paradigm.

168 See, for example, my discussion of the Moog synthesizer in the conclusion of this document.

B. Babbitt's Synthesizer

We can look to Babbitt's own words as a starting point for what the synthesizer meant for him:

> There were any number of people who seemed to have the notion that composers turned to electronics because they wanted new sounds. . . Nothing could be farther from the truth. . . A composer knows better than anyone else that a new timbre becomes old quicker than anything in the world. What composers were dissatisfied with was the situation of the temporal aspect of music. . . This is what led most of the composers to the electronic domain originally. It was not only because of the rhythmic problems of individual performance, or the ensemble performance of rhythm, but because of the whole rhythmic question – rhythm in every sense of the aspect.[169]

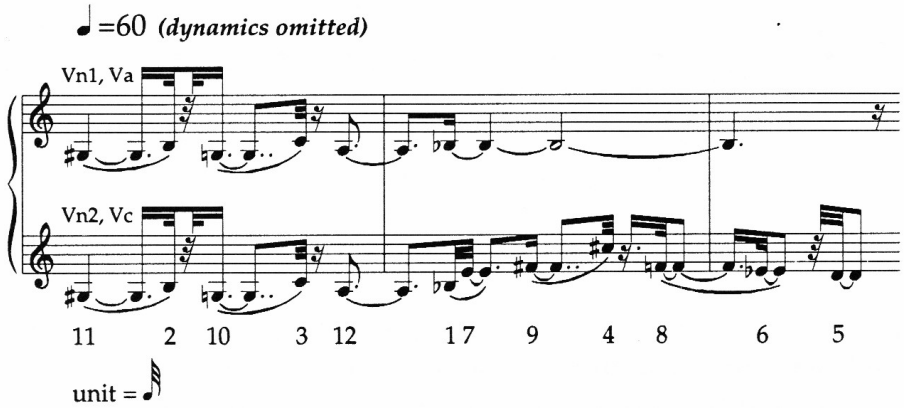
While his assignation of his own motivations for turning to electronic media to other composers is perhaps dubious, Babbitt's statement does give a clear direction for his own experiments in the medium. While I believe that the synthesizer did have a noticeable effect on his timbral practice, particularly with regards to his use of vocal timbre, his claims that the synthesizer helped to transform rhythmic practice are most clearly substantiable. There is a conspicuous gap in Babbitt's compositional output in the years 1958-59. This is precisely the time when he was experimenting with the RCA synthesizers most intensely, and one might say that his first published works for synthesizer were, in fact, the works for acoustic instruments he published after this period of experimentation. The first pieces he released after this gap were two vocal works released in 1960: *Sounds and Words* (for soprano and piano), and *Composition for Tenor and Six Instruments*. Focusing on *Sounds and Words* and comparing it with later electronic works like *Phonemena,* I hope to show that the possibilities the synthesizer offered were a vehicle for realizing Babbitt's evolving conception of serialism.

One of the most important innovations the synthesizer represented was Babbitt's method

169 Milton Babbitt, *Words About Music* (Madison: University of Wisconson Press, 1987), 173-174.

for the serialization of rhythm, as can be seen in Babbitt's decision to introduce the time-point system (the dominant rhythmic serialization scheme of his second period) in an article titled, "Twelve-Tone Rhythmic Structure and the Electronic Medium."[170] Throughout Babbitt's first period (as reckoned by Andrew Mead), Babbitt's method of rhythmic serialization a based largely on duration rows. His perfected method of this rhythmic serialization (seen at the end of his first period) is based on orderings of twelve durations, increasing in incremental size using division of the beat as a unit, and ordered as straight numerical translations of the work's rows.[171] (An example of this, from Babbitt's second String Quartet, can be seen in fig. 2.3). Mead notes that there are a number of disadvantages to this, particularly in the realm of metrical perception on the part of the listener: any complete row of durations will be seventy-eight durational units long, and consequently, if the sixteenth note or thirty-second note is used as the durational unit, one is left with remainders of the beat at the end of a duration row.[172]

Figure 2.3 – Mead's Example of a Duration Row, from String Quartet no. 2



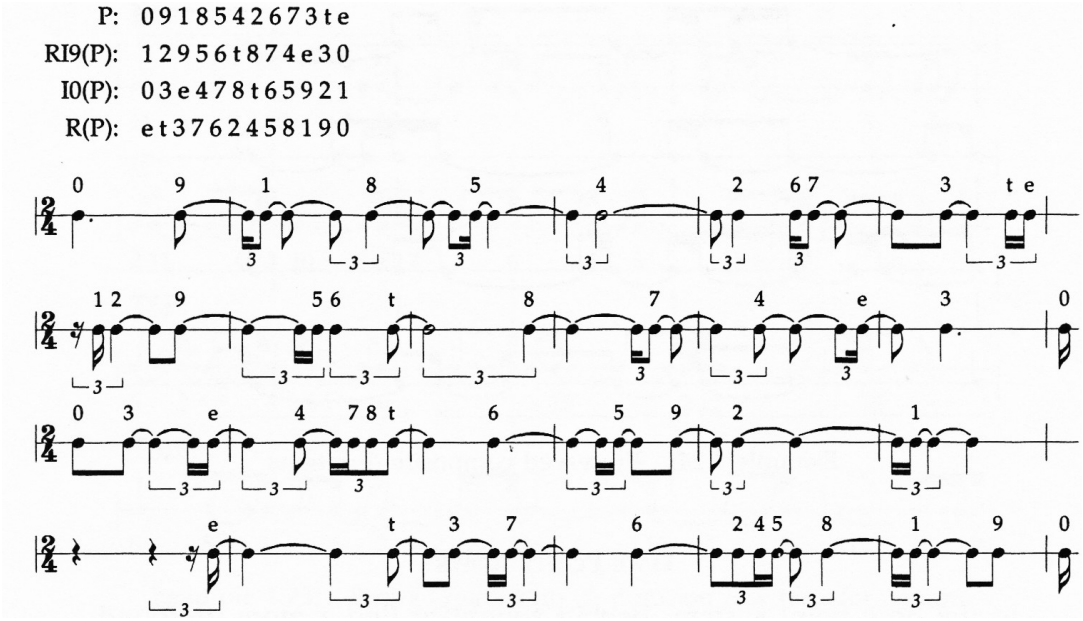
170 Milton Babbitt, "Twelve-Tone Rhythmic Structure and the Electronic Medium," in *Perspectives in New Music* vol. 1, 1 (Autumn, 1962).

171 Andrew Mead, *An Introduction to the Music of Milton Babbitt* (Princeton: Princeton University Press, 1994), 39.

172 Mead, 40. Mead seems to believe the time point system to be better able to convey a sense of meter to listener, a claim which I take issue with, and will explore more in depth further on.

Additionally, there are structural issues with this type of scheme that make the translation from pitch to duration, at the very least, imperfect. For instance, transposition of the row scrambles the length of the mod-12 duration intervals, so there is no longer a perceptual tie between P forms of the row (the duration 11, transposed at a T_3P operation, would become 2, while the duration 1, at the same operation, becomes 4. The relative relationships between these positions therefore change).[173] The time-point system ameliorates these problems, at least in theory. This method of rhythmic organization portions a time span (as defined by measures, generally) into twelve equal possible attack points (the duration of which is referred to as the "modulus"). Babbitt creates a clearer analog to pitch-row-based serial operations in the rhythmic realm.[174] See figure 2.4 (taken from Mead) for a time-point row and the standard serial transformations applied to it.

Figure 2.4 – Time Point Row and Transformations[175]



173 Mead, 42-43.
174 Mead, 47.
175 Taken from Mead, 46.

Given that Babbitt introduces this rhythmic methodology (which would come to dominate his practice) in an article that explicitly references electronic music, we must wonder what this particular scheme has to do with electronic music. As Babbitt points out in the article, there is no reason the time-point system cannot be adopted to the acoustic realm, stating:

> The system crucially depends upon the maintenance of an isochronous durational unit and its multiple, the measure, the modular unit. To secure this, with non-electronic media, is not only to court the terrifying and cumulative hazards associated with the presentation of ensemble rhythms of any complexity, but to be obliged to assume a quite coarse quantization of the temporal continuum.[176]

As mentioned above, a composer did not input metrical parameters into the machine; rather, the tempo was determined by the intake speed of the programming tape (it is worth noting that in the article outlining the synthesizer, Belar and Olson do not use the word "tempo" at all, instead using "speed").[177] Because duration was recorded primarily as length of tape,[178] from a programming standpoint, duration becomes a natural consequence of the placement of new pitch events. Rather than measures, one would think in the division of seconds, and place pitch events accordingly. This primacy of seconds of tape as a demarcating tool makes more obvious a possible parameter for serialization: the time in seconds it takes to play given passages in sequence. This would become a dimension Babbitt experimented with as he worked with the synthesizer, as well as in concurrent acoustic works like *Sounds and Words*. While such a scheme is attractive to a composer seeking total serial unity in a piece's musical parameters, trying to combine this while at the same time expressing the array structure through time-points unavoidably undermines a sense of

176 Babbitt, "Twelve-Tone Rhythmic Structure and the Electronic Medium," 73.
177 Olson and Belar, 606.
178 Milton Babbitt, "The Synthesis, Perception and Specification of Musical Time, " in *Journal of the International Folk Music Council* vo. 16, (1964), 93.

unifying meter (which risks making the entire system aurally incomprehensible for a listener), and has the potential to create great difficulties for a performer.

Though theorists have a number of competing theories regarding the nature of meter, there is general agreement on the importance of a recurring accent structure. Lerdahl and Jackendoff note that meter is reliant on "the regular, hierarchical pattern of beats to which the listener relates musical events."[179] Mead is aware of this. In his discussion of the time-point system, he notes that in order for it to have meaning to the listener, the system must "unfold against a regular metrical background."[180] However, this raises immediate questions: chiefly, how is that metrical background established? A metrical background is not established in full simply by notation, and if each part expresses the time-point array, which, by design, must be a constantly shifting statement of aggregates, then there is a real question about whether it is feasible to actually have an established metrical structure, even with an unchanging beat unit; in this model, accent points are determined not by a repeating musical fabric, but by perpetually re-arranged, predetermined aggregates.

In theory, this is not any more metrically problematic for perception than Babbitt's duration row method, which inevitably undermines a regular pulse as the different parts project the aggregate as translated into durations. In practice, however, the time-point system allows for an even more radical dismantling of a metrical framework. Though there are certainly exceptions, in Babbitt's use of the duration row model, the basic rhythmic unit tends to remain more or less consistent, which allows the durations to be based on an unchanging duration unit. In the time point system (particularly in the early examples), he apparently feels no such compulsion, and rapidly shifts the time span which he subdivides into twelve

179 Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge: The MIT Press, 1983), 17.
180 Mead, 49.

attack points (known as the modulus). As we can observe in *Sounds and Words*, this has important ramifications for comprehensibility.

Babbitt is somewhat cavalier in his assessment of the difficulties this can pose to a performer. The system he describes (and the synthesizer utilizes) is not merely complex rhythmic figuration to be botched by unenthusiastic musicians. Fundamentally, the conception of the rhythmic domain as a clock ticking away, rather than as a repeating metrical framework giving structure to individual rhythmic figures, is simply not how most performers traditionally learn to conceive of and function within musical time. Yet this is precisely the way that the RCA synthesizer encouraged a composer think, and is the primary tie to the time-point system – a very natural consequence of the way rhythm was controlled and input into the system.

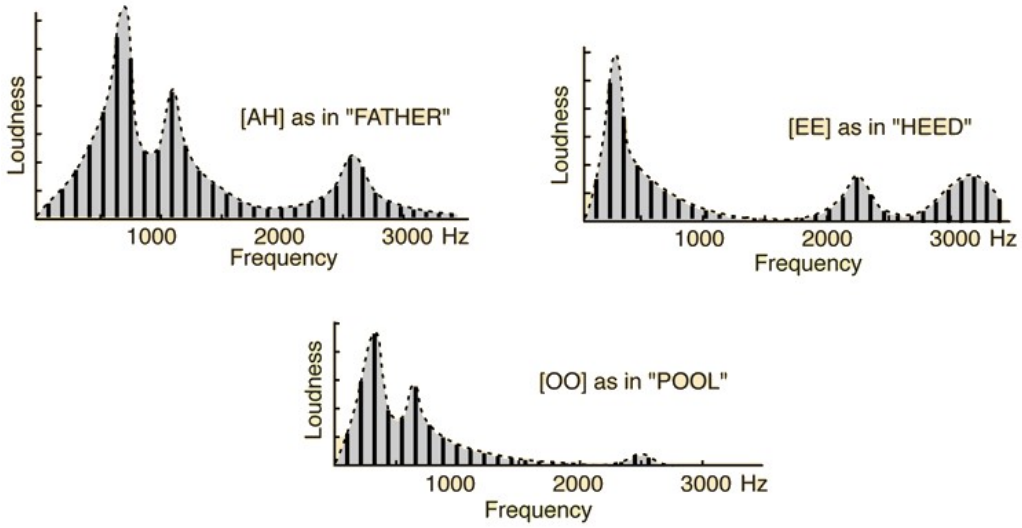
The desire to unify musical aspects of a work through serial organization drove much of Babbitt's musical experiments in this period, and though the rhythmic domain is the most obvious place where one can observe how the RCA synthesizer helped facilitate this, the possibilities of the synthesizer's filter system for timbral serialization deserves some attention as well. Though Babbitt downplays timbre as being a driver of experimentation with electronic media, the filter/resonator system that the RCA synthesizer necessarily forced users to think of timbre in a way they would not have to while composing for acoustic instruments. For Babbitt, this system allowed a type of serialization of timbre that becomes especially clear when analyzing pieces like *Phonemena*. Additionally, there are traces of the effects of the subtractive synthesis system in the way Babbitt treats timbre in some of his acoustic pieces, particularly in his serialization of vocal parts. During the time period of his most concerted experimentation and composition with the RCA synthesizer (ca. 1957-1979)

there is a higher density of works written for voice (nine of thirty-one employ voice) than at any other period of similar length in his output. One possible reason for this might be the potential of phoneme serialization, which matches well with the timbral capabilities of the synthesizer. The potential for speech applications was, as Maconie notes, very much a likely goal of the synthesizer project from its inception,[181] though it is tricky to postulate on whether his work with the machine directly inspired Babbitt's method of vocal serialization, or if it gave an avenue to an already established compositional interest.

A notable early application of subtractive synthesis, the vocoder (which Bell Labs developed and launched in late 30s and early 40s,)[182] was focused on speech applications. While the RCA synthesizer lacked a signal analysis function and the banks of bandpass filters key to a vocoder, the capabilities of the synthesizer, in the form of bandpass filter and resonator chain, could, through manually programmed means, be used to create an approximation of vocal formants. Vowel formants, which give each vowel its characteristic sound, are formed by the sound's patterns of relative loudness, known as its spectrum envelope.[183] For human speech, this is determined by the shape of the air column.[184] Below (see fig. 2.5) is a representation of the frequency spikes that convey three different vowel sounds.

181 Maconie, 32.
182 Maconie, 32.
183 Arthur Benade, *Fundamentals of Musical Acoustics* (Oxford: Oxford University Press, 1976), 372-374.
184 Benade, 372.

Figure 2.5 – Sample Peaks for Vowel-Sound Formants[185]



For someone trying to serialize every possible musical dimension, timbre creates more apparent conceptual difficulties than, for example, pitch or rhythm. However, vowel sounds are, in essence, linked to timbre. We form these sounds more or less unconsciously in our speech, and they are easily recognizable. Consequently, vocal music offers a level of timbral control that is perhaps more immediately relatable (at least, from the perspective of serialization) than that of instrumental music: different vowel sounds could be assigned a number, and that arrangement can be mapped onto a pitch or time-point array.

One can create these vowel sounds artificially through a number of means: it is certainly possible to use an arrangement of acoustic instrumental sounds to approximate the characteristic frequency peaks. That said, it would be more precisely controlled through electronic means: for example, using sine waves to build them through additive synthesis, or by using subtractive synthesis, in the manner of the RCA synthesizer. The RCA synthesizer's combination of filters and resonators was certainly capable of producing vowel-formant-like

185 From Benade, 373, posted on http://hyperphysics.phy-astr.gsu.edu/hbase/Music/vowel.html

spectra, and Babbitt later uses this to great effect in *Phonemena.*[186] However, I believe early experiments of this form of timbral serialization can be seen in the vowel-centric approach to the vocal lines he takes in the two works (both acoustic) he completed and released in 1960: *Composition for Tenor and Six Instruments,* and the main subject of this chapter's study: *Sounds and Words*.

C: Sounds and Words *(1960)*

For Babbitt, working with the synthesizer was clearly a transformative experience, and its influence on his compositional practice can be seen in acoustic pieces that he composed before officially releasing any of his compositions for the synthesizer itself. Both *Sounds and Words* and *Composition for Tenor and Six Instruments* show an important – if ultimately complicated –relationship to Babbitt's use of electronic media.

Sounds and Words is a short (2'36", if performed as specified) work for piano and voice. In the pitch realm, it shows a continuation of the array structures Babbitt had been experimenting with for some time, though rather than his earlier trichordal array or later all-partition array schemes, the work is something of a middle ground. Joseph Dubiel posits the P_0 form of the row to be (092483ET1756).[187] There are interesting aspects to Babbitt's choice of the hexachords that underpin this array, in that he eschews the all combinatorial hexachords that he uses in so many works. Andrew Mead notes that he employs (012478) and (012568), neither of which is combinatorial in any notable way; however, the first of the two contains all twelve possible trichordal types within it, "in effect marking the hexachordal

186 See Mikel Kuehn, "The Phenomena of Phonemena: Structure and Realization in Milton Babbitt's Work for Soprano and Synthesized Tape" (PhD diss. Eastman School of Music, 1995), 23.

187 Joseph Dubiel, "Review Essay: *Composition with Pitch-Classes: A Theory of Compositional Design*, by Robert Morris," in *The Journal of Musicological Research*10:1-2 (1990), 63.

apotheosis of his first period's trichordal underpinnings."[188] The full row itself is an all interval row, which has important ramifications for the work's macro-structure, as we shall see.

The piece's complete array can be seen in the example below, taken from Dubiel's analysis (see fig. 2.6).[189] The different lynes[190] of the pitch class array are expressed via instrument and register; the voice expresses the top two lynes, while the piano expresses the bottom two. The registral boundary happens between B4 and C5, with each of these pitches functioning sometimes within the upper lynes, and sometimes in the lower. The array strongly emphasizes hexachords; aggregates are not formed in single horizontal lynes. Rather, they are unfolded simultaneously between the top two and bottom two hexachords, as well as between simultaneous partitions. This was not the first time Babbitt employed irregularly partitioned aggregates – different versions of this scheme also appear in *Partitions* and the *Woodwind Quartet*)[191] – and as suggested above, most of this work's innovations, and most overt ties to Babbitt's work with the RCA synthesizer, lie in the realms of rhythm and vocal timbre.

188 Mead, 126.
189 Dubiel, 62-63.
190 Mead defines *lynes* as the array's "horizontals, before they are interpreted musically." (Mead, 20).
191 Mead, 113.

Figure 2.6 – Pitch Array of *Sounds and Words*, Adapted from Dubiel (1990)

Section 1

495	3T1	749	E3T
768	2E8	658	201
12E	576	01E	587
03T	849	3T2	496

Section 2

4	5390E	23068	7
T1862	7	T	5E042
9	8T412	5471E	0
3057E	6	9	2T836

Section 3A

769	312	ET0	634
85T04E			819725
231	7T9	674	T0E
	5046E8	583192	

Section 3B

	E6T052	E29738	
897	143	01T	465
2E46T5			27318E
103	978	546	09T

Section 4

09248	3	0	51E69
6	571TE	87T42	3
7T53E	4	1	80274
1	20698	5639E	T

Section 5

342	8ET	452	8T9
615	709	361	E70
T70	261	708	614
98E	534	T9E	523

As mentioned above, Babbitt's serialization of the vocal part is tied closely with timbre. *Sounds and Words* uses a novel system of serializing the lyrics, in that the object of serialization is the phonemes themselves. There is something of an antecedent to this in *Composition for Tenor and Six Instruments,* Babbitt's own words would suggest that the phonemes themselves are not serialized: "The tenor in that piece used only phonemes, and the phonemes were indeed chosen in order to either contrast or blend with the instruments. Sometimes it worked very well, and sometimes it didn't."[192] This work, composed in the same year as *Sounds and Words* (but apparently slightly earlier[193]), would seem to treat the vocal phonemes as a non-serialized parameter. However, it does show Babbitt's attention to timbre during this period; he was specifically trying to use the syllables to blend or contrast with instrumental timbre.

192 Babbitt, 1983, quoted in Zachary Bernstein, "Reconsidering Organicism in Milton Babbitt's Music and Thought," (PhD diss., City University of New York, 2015), 49.

193 See Bernstein, 49. Apparently, Babbitt wrote *Sounds and Words* as a way to explore composition with phonemes "on a simpler basis" than *Composition for Tenor and Six Instruments*.

Sounds and Words does seem to use these phonemes as part of the serial architecture, but in a way that is less developed than in *Phonemena* (1969), to which I will later compare this work. In the former's case, Babbitt employs twelve vowel sounds, as well as twelve consonants: B, T, L, S, M, N, G, H, D, P, V, and F. However, the consonant phonemes are used in dramatically uneven quantities: for instance, “T” appears fourteen times, while “V” and “S” only appear once. Consequently, in spite of the auspicious total quantity of consonants, I believe that it is the vowels that are employed serially. When we examine the usage of the vowels with the vocal part's pitch classes, it begins to very much look like Babbitt is employing phoneme “aggregates.” See Figure 2.7, below.

The chart can be read for each pitch class from top to bottom, with the top cells being the first syllable used in the singer's part for that pitch class, and the last cells being the final. I have removed the consonants the vowels appear with for clarity, with three exceptions: three voiced consonants that are presented unpaired with vowels (they are recorded in green). Characters in red are those that have been reused. The same graph can be represented, organized by syllable rather than pitch class (see fig. 2.8).

This representation is inconsistent enough with regards to conventional ways of forming aggregates to raise doubts its place in the larger serial scheme. These irregular aggregates may be the result of a focus on other features, or a compromise in expressing other serial parameters. However, there are some issues that are harder to understand: the use of isolated unpaired consonants, as well as the omitted syllables for the pitch classes 8, 9, and 11, for example. Babbitt could have substituted a missing syllable for one of the doublings.

Figure 2.7 – Vowel-Sound "Array" from *Sounds and Words*

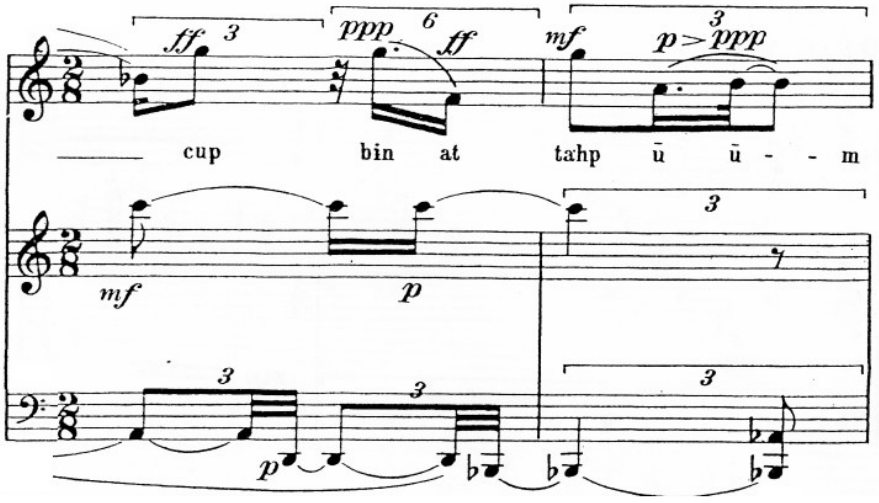
PC:	0	1	2	3	4	5	6	7	8	9	T	E
	aw	ow	i	ū	ā	ē	m	ī	u	ah	a	e
	ow	ō	u	e	aw	ī	ē	ē	ē	i	ā	ō
	ah	ū	ō	L	ē	ow	ah	ow	ī	e	e	a
	a	i	ē	aw	ī	a	u	e	ū	ū	ī	n
	ō	ā	ū	ī	ū	i	ō	aw	ō	ō	ow	ū
	ī	e	ā	ē	ah	ō	ā	u	ow	ī	ō	ah
	u	aw	ah	a	e	aw	ow	i	i	ē	u	aw
	e	ē	e	ow	i	ah	a	ah	ā	u	ah	u
	ē	ī	aw	ō	ō	ū	ū	a	aw	aw	ū	ī
	ā	a	ī	ah	ow	u	ī	ū	a	ow	i	i
	i	u	a	ō	a	ā	en	ō	ū	a	e	ē
	ū	ah	ow	ā	u	e	i	ā	ah	aw	aw	ow
	ī	ō		u			aw	ē	ō	ī	ē	ē
		ā		i				a		ah	a	
								e				
								ū				
Missing:	–	–	–	–	–	–	–	–	e	ā	–	ā

Figure 2.8 – Vowel Array, organized by Phoneme

Vowel																Missing PCs
ā	4	T	1	6	2	8	7	0	3	5	1					9, E
ah	9	6	0	3	7	4	E	T	2	5	3	1	8	9		
aw	0	4	7	3	1	E	5	8	9	2	T	9	6			
a	T	E	0	5	7	3	6	1	8	7	4	2	9	T		
e	E	3	9	7	9	1	4	0	2	T	6	7	5			8
ē	5	8	6	7	T	4	2	3	1	9	0	7	E			
i	2	9	1	7	5	8	4	T	E	0	6	3				
ī	7	5	8	T	4	3	0	9	1	E	6	E	2	9	0	
ō	1	E	2	0	6	8	T	9	5	7	4	3	1	8		
ow	1	0	7	5	T	8	6	3	4	9	E	2				
u	8	2	6	7	T	0	E	9	1	5	3	4				
ū	3	1	8	9	E	4	2	7	T	6	5	8	0	7	0	

Regardless, the presence of so many well-formed aggregates in this context would suggest that this representation cannot be purely coincidental. Phoneme reuses occur, for the most part, after the vocal aggregate has been completed. The presence of more sounds employed for some pitch classes than others is a consequence of the way the Babbitt interprets the lyne structure musically. Because the singer's part is divided between two lynes, In many cases, a pitch presented in one of the lynes will be interrupted by a pitch in the other, before reestablishing the first pitch. This will necessitate a change of syllable, but for the purposes of the pitch class array, the lyne will not have changed pitches. An example of this can be seen in m. 22-23 (see fig. 2.9), where multiple syllables ("cup," "bin," and "tahp") appear on what counts as a single iteration of pc 7 in the vocal part.

Figure 2.9 – Asynchronicity of Pitch-class and Syllable Lynes in *Sounds and Words*



While the phoneme system in *Sounds and Words* does seem to be pointing to serialization in a way that it does not in *Composition for Tenor and Six Instruments*,[194] it does not seem to be as integrated into the serial structure as it does in *Phonemena,* where Babbitt

194 Which, while using the phonemes to blend with instrumental timbre, does not seem to have employed phonemes in aggregate formations.

uses the phonemes to articulate time-point lynes. Even so, it appears to be an early effort at serializing timbre within a single part, and serializing timbre using a method that was mappable to the capabilities of the RCA synthesizer.

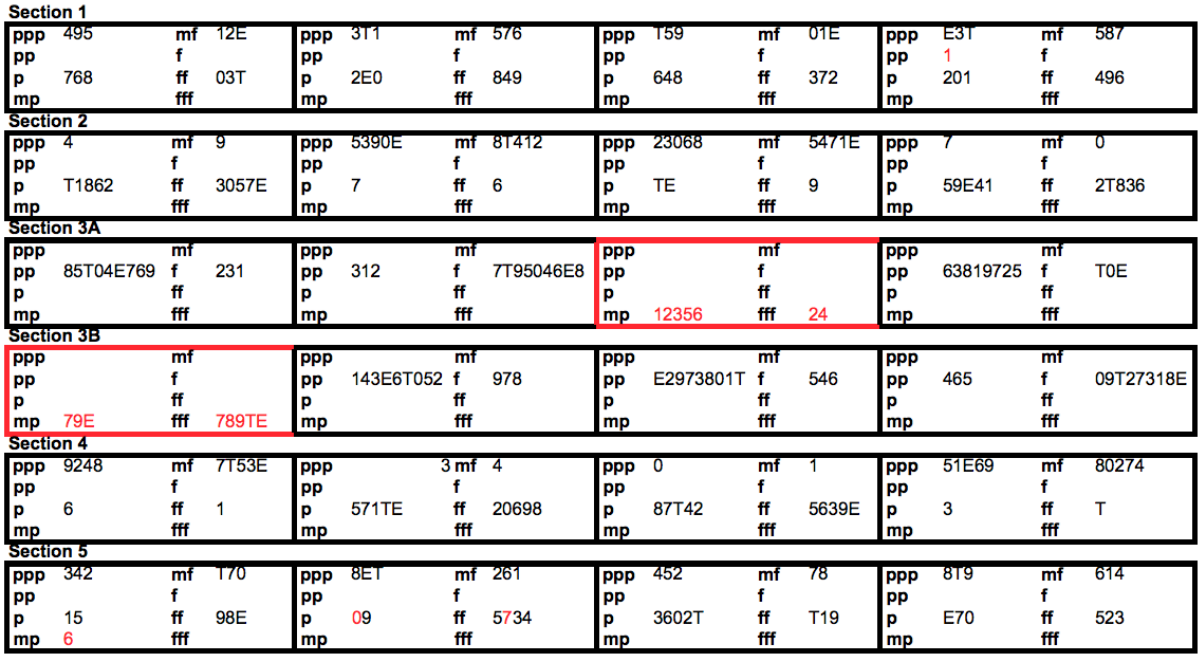
It is especially in the realm of rhythm – in Babbitt's application of the time-point system – that the tie Babbitt's work with the synthesizer becomes especially clear. The extreme control over rhythmic precision it offered, coupled with the piece's tie between sectional durations and the pitch intervals of the row, show that this work was written with the capabilities of the electronic medium in mind. The time-point array follows of *Sounds and Words* follows the pitch-class array closely, and somewhat unusually,[195] unfolds concurrently – each pitch-class partition unfolds in the same block in the rhythmic realm. The time-point lynes are differentiated by means of dynamics. Sections 1, 2, 4, and 5 primarily employ the dynamics of *ppp*, *p*, *mf*, and *ff*, while 3a and 3b primarily employ pp and f. My reckoning of the time-point array is found in fig. 2.10. Entries in red represent deviations from the pitch-class array, and I've outlined the two most glaringly anomalous sections, the third block of section 3a, and the first block of section 3b.

To understand why Babbitt diverges from the array in this way, one must understand the large-scale duration serialization in the work. In his analysis of *Composition for Tenor and Six Instruments,* Zachary Bernstein notes that *Sounds and Words* uses a similar scheme for durational serialization: the duration in seconds for each block, when examined in sequence, is the ordered interval content for the row, first stated for the P form, then for the RI form (and since the RI form returns the same interval values in opposite order, this is essentially a retrograde of the durations), supplemented with two "neutral" twelve-second blocks in the

195 Mead notes that in Babbitt's mature use of the time-point system, the pitch and rhythmic domains tend to unfold at different rates (48). This is another aspect of *Sounds and Words* that points to its transitional nature.

middle and at the end of the piece (see fig. 2.11).[196]

Figure 2.10 – Time-Point Array for *Sounds and Words*



Section 1												
ppp	495	mf	12E	ppp	3T1	mf	576	ppp	T59	mf	01E	ppp	E3T	mf	587
pp		f		pp		f		pp		f		pp	1	f	
p	768	ff	03T	p	2E0	ff	849	p	648	ff	372	p	201	ff	496
mp		fff		mp		fff		mp		fff		mp		fff	
Section 2												
ppp	4	mf	9	ppp	5390E	mf	8T412	ppp	23068	mf	5471E	ppp	7	mf	0
pp		f		pp		f		pp		f		pp		f	
p	T1862	ff	3057E	p	7	ff	6	p	TE	ff	9	p	59E41	ff	2T836
mp		fff		mp		fff		mp		fff		mp		fff	
Section 3A												
ppp		mf		ppp		mf		ppp		mf		ppp		mf	
pp	85T04E769	f	231	pp	312	f	7T95046E8	pp		f		pp	63819725	f	T0E
p		ff		p		ff		p		ff		p		ff	
mp		fff		mp		fff		mp	12356	fff	24	mp		fff	
Section 3B												
ppp		mf		ppp		mf		ppp		mf		ppp		mf	
pp		f		pp	143E6T052	f	978	pp	E2973801T	f	546	pp	465	f	09T27318E
p		ff		p		ff		p		ff		p		ff	
mp	79E	fff	789TE	mp		fff		mp		fff		mp		fff	
Section 4												
ppp	9248	mf	7T53E	ppp		3 mf	4	ppp	0	mf	1	ppp	51E69	mf	80274
pp		f		pp		f		pp		f		pp		f	
p	6	ff	1	p	571TE	ff	20698	p	87T42	ff	5639E	p	3	ff	T
mp		fff		mp		fff		mp		fff		mp		fff	
Section 5												
ppp	342	mf	T70	ppp	8ET	mf	261	ppp	452	mf	78	ppp	8T9	mf	614
pp		f		pp		f		pp		f		pp		f	
p	15	ff	98E	p	09	ff	5734	p	3602T	ff	T19	p	E70	ff	523
mp	6	fff		mp		fff		mp		fff		mp		fff	

Figure 2.11 – Duration of Modulus Blocks in *Sounds and Words* (from Bernstein)

First Measure	1	4	6	8	10	14	18	22	25	31	36	37
Duration (seconds)	9	5	2	4	7	8	11	3	6	10	1	12

First Measure	43	44	49	55	59	63	67	71	75	78	80	82
Duration (seconds)	1	10	6	3	11	8	7	4	2	5	9	12

This large-scale serialization of duration is novel, but causes complications for performance, necessitating the anomalous measures. Bernstein predicts it would take four full moduli within those one-second spans in order to accommodate the expected time point material – this would necessitate a time-point unit duration of 1/48th of one second – a likely technical impossibility for human ability.[197] This piece makes extraordinary demands on the performers, in terms of correctly realizing the time-point structure (I will explore the

196 Bernstein, 55.
197 Bernstein, 57.

ramifications of this later), and it seems that this was where Babbitt felt the limits of human ability lay. Consequently, Babbitt substitutes two measures here that ignore their expected time point blocks. It makes the most sense to imagine these two measures as a single unit (though their time-point unit is not identical), with ordered attack points in positions one through twelve (see fig. 2.12 for the score of mm. 36-44).

The other anomalous attack points (seen recorded as individual red numbers in fig. 2.10) have many possible explanations. For example, in the last block of section 1, there is a *pp* attack in the piano part, doubling the *p* attack of the vocal line (m. 9); perhaps, since the vocal part specifies a diminuendo between the first and third attack, the *pp* attack in the piano was specified for purely musical reasons (see fig. 2.13).

Many anomalies are harder to explain, however. Section 5 freely intersperses time-points between different dynamic levels, and it is not clear why – for example, in the first block of section 5, the time point in position 6, played in the piano, is specified *mp* for no clear musical reason (one would expect it to be *p*). The second and third blocks of the section have similar anomalies, and whether they are intentional or the product of typos is unknown. It is worth noting that the last section also has a departure from the pitch-class array: Bernstein remarks that the only convergence in pitch between the soprano and piano part is the very last sonority of the work, and it is unexplainable by the pitch array.[198] Presumably, this is a way of closing out the work, though the presence of the pitch anomaly nonetheless raises questions about the time point "mistakes." Overall, however, Babbitt hews quite closely to the expected array.

198 Bernstein, 236.

Figure 2.12 – *Sounds and Words*, mm. 36-44 (Anomalous Time-Point Measures)

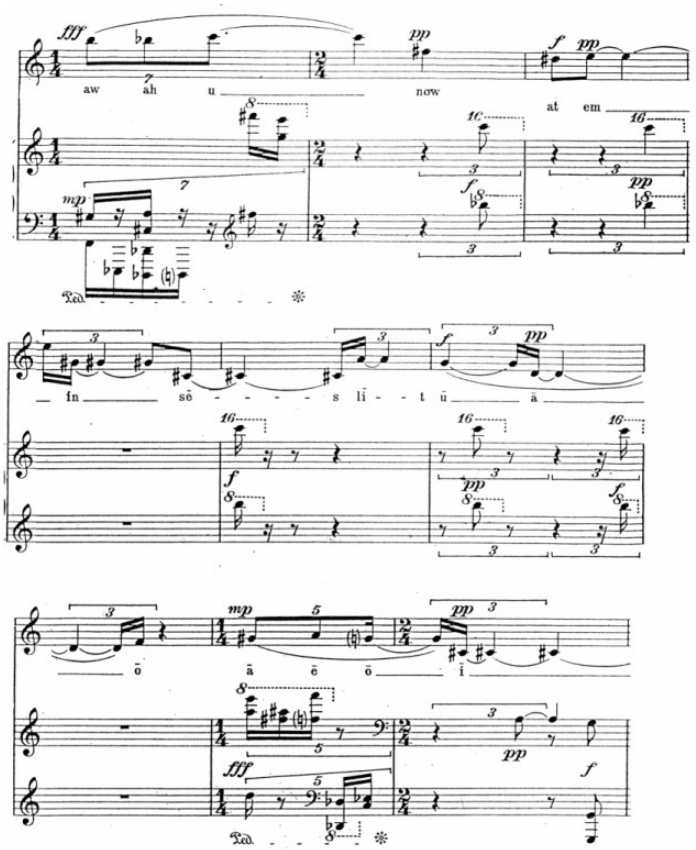
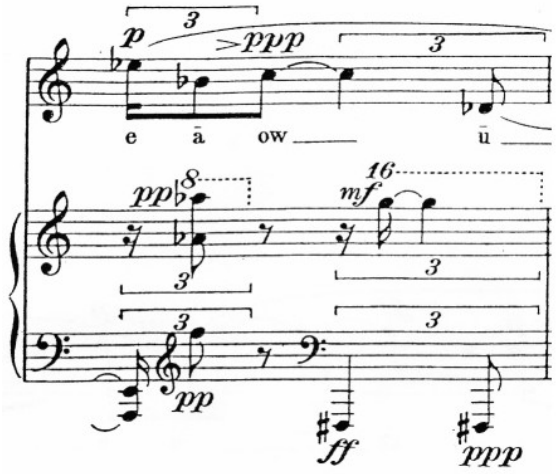


Figure 2.13 – Anomalous *pp* in m. 9 of *Sounds and Words*



There is a fundamental conflict in this piece that points toward the advantages of adopting the electronic medium. Babbitt seems to have held (at least in 1958), that perceiving the serial organization of a work is crucial to that work's communication of meaning. He writes in "Who Cares if You Listen:"

> Inability to perceive and remember precisely the values of any of these components [pitch-class, register, dynamic, duration, and timbre] results in a dislocation of the event in the work's musical space, an alternation of its relation to all other events in the work, and-thus-a falsification of the composition's total structure. For example, an incorrectly performed or perceived dynamic value results in destruction of the work's dynamic pattern, but also in false identification of other components of the event (of which this dynamic value is a part) with corresponding components of other events so creating incorrect pitch, registral, timbral, and durational associations.[199]

If the serial structure of the work is paramount to its musical meaning, then it is vital that the performer accurately reflect it, and that the listener be able to perceive it. As Babbitt developed his ideas for total serialization of all musical parameters, he inevitably began to bump into practical difficulties with these requirements. The issue of perception can be glossed over somewhat, since it is personal. Issues of performance accuracy, however, are more difficult to sidestep. Composing for the electronic medium would allow Babbitt to continue his theoretical developments while solving at least some of these issues, and aspects of *Sounds and Words*, in particular the dynamic serialization and the practicalities of its time-point array, very much point to the work as being, at least conceptually, a piece for the synthesizer, transcribed for live performers. As we shall see, the results of this necessitate either relying more on the electronic medium or simplifying the parts of human performers. Babbitt would go on to do both.[200]

While the dynamic-based arrangement of time-point organization allows, at least on a localized level, enough difference to keep the lynes distinct, one does wonder about the

199 Milton Babbitt, "Who Cares if You Listen," in *High Fidelity* (February, 1958), 39.
200 Bernstein, 50.

feasibility of reflecting all eight dynamic levels, accurately and unchangingly, across a complete performance. How do performers fare with this, and is it a scheme that would be better utilized in an electronic medium? Not necessarily. Mead notes: "If . . . we read Babbit's dynamic notation to indicate inflections within a normal range of dynamics, we can hear in his music a series of contours of intensity that maintain their identity under various sorts of transformations.[201]"This is sensible enough; if the performer is up to it, the different relative dynamic levels should be adequate to distinguish the lynes. In practice, however, often times (as is the case with *Sounds and Words*) this is complicated by the fact that the time-point array is communicated by multiple performers concurrently. Even with only two performers, if each performer has slightly different ideas about what constitutes a dynamic, the system could be utterly muddled in the perception of the audience. For example: each performer might keep a consistent relative dynamic level, but in practice, the pianist's *p* could conceivably be at a similar dynamic intensity as the vocalist's *mf*. This would result in an unclear projection of the time-point lynes. It would be an aid to performers to have at least one of the parts realized by tape, as it would allow them the calibrate their dynamics to an unchanging reference point. Likely, it is not coincidental that Babbitt's discussion of dynamics in his introduction to the synthesizer shows great understanding of the different parameters that project our impression of dynamics:

> ...the last stage, that of intensity control, can be applied to a level uniform for all incoming spectra. The intensity, or volume control, code numbers determine the intensity level, and thus can completely control the "loudness" of an event with a specified frequency, octave, envelope, and spectrum, each of which can alter the loudness level of a tone whose intensity level remains fixed. The intensity control, then, provides loudness with uniformity and determinacy, and – also – makes the time rate of change of loudness completely controllable, so that the rhythm of dynamics can be accurately specified.[202]

201 Mead, 176.
202 Babbitt, "An Introduction to the RCA Synthesizer," 256.

If this piece were composed for the synthesizer, it would be easily possible to ensure uniform dynamic levels across different parts. For different performers playing different instruments, however, this becomes far more difficult to ensure, particularly when this dimension is combined with the exceedingly demanding rhythmic and pitch parameters.

There are graver problems, however, with the time-point system of *Sounds and Words*, both in terms of feasibility of an accurate performance, and in terms of comprehensibility on the part of the audience. These issues revolve around the rapid but subtle changes in the modulus in this work. For a performer who has the aid of a score, this is not a fatal problem. Judicious practice with a metronome could well be enough to ensure proper placement of the attack points. However, an audience member without a score might be hard pressed to hear a steady beat, as there would not necessarily be any recurring pattern of alternating stress. This is not to make any statement about the relative artistic or structural merits of the system; rather, it is to establish the difficulties with audience comprehension of the system, even in the best of circumstances.

This issue is compounded when the modulus changes over the course of the work. In the case of *Sounds and Words,* while the tempo remains a steady quarter note = 60[203] for the vast majority of the work, the modulus changes frequently. While the time-point unit starts as a 16th note in 3/4 (meaning that there are 12/3 = 4, x 60 = 240 TP units per minute), after the first three measures, it becomes a sixteenth note sextuplet in 5/8, dividing the 5/8 measure into twelve equal parts (meaning that there are 12/2.5 = 4.8, x 60 = 288 TP units per minute). Below (fig. 2.14) is my calculation of the different time-point unit tempi for the entire piece.

203 This tempo also might indicate a conversion from the clock-time-based rhythmic orientation of the RCA synthesizer.

Figure 2.14 – Time Point Unit Tempi (in bpm) for *Sounds and Words*

Measures	TPU Tempo	Measures	TPU Tempo
1–3	240	43	300
4–5	288	44-48	360
6–7	720	49-54	720
8–9	360	55-58	960
10–13	411.43	59-62	261.82
14–17	360	63-66	360
18–21	261.82	67-70	411.43
22–24	720	71-74	720
25–30	720	75-77	1080
31–35	360	78-79	288
36	420	80-81	216
37–42	360	82-84	180

If the task of tracking a meter was difficult for a listener before, under ideal circumstances, then under this model it becomes nigh impossible, unless, for example, they had the aid of a scrupulous percussionist keeping the quarter note = 60 passage of time.[204] It also exponentially increases the difficulty for the performer, who must keep track of ever-shifting, modulus units, some of which are very close in tempo to others.

A study of early time-point works like *Sounds and Words* raises the question: how much of a departure does this system represent, as compared to Babbitt's previous rhythmic practice? Conceptually, it is quite different. In terms of performance difficulty, though, it would not seem to be particularly profound change. Babbitt's music prior to these works (ending with *Partitions*) is certainly rhythmically complex, and can be ametric. However, none of the earlier works attain quite the same level of the combination of intricate rhythmic figuration and a functionally ametric grid against which those rhythms must be realized. For example, *Two Sonnets* (1955), Babbitt's last vocal work before before *Sounds and Words,* and *Composition for Tenor and Six Instruments,* seems rhythmically and metrically

204 And in the end, even this would be inadequate, as there are just enough tempo changes in the work to upset such a scheme.

elementary when compared with the later works. The two pieces stay in unchanging tempi for their duration, and the time signatures never depart 2/4, 3/4, 4/4, or 5/4. the most adventurous tuplet that appears is a quarter-note quadruplet in a measure of 3/4 (m. 96). This work inhabits a completely different rhythmic paradigm.

Even what is arguably Babbitt's most rhythmically complex work prior to the two 1960 vocal works, *Partitions* for piano (1957), does not achieve the same levels of rhythmic and metric opacity. The tuplet patterns in the work are almost entirely triplets or sextuplets, which is a function of the rhythmic scheme he uses to organize it: Babbitt employs nearly all fifty-eight partitions of twelve into six or fewer parts, and to facilitate this, the unit duration changes between the sextuplet and the sixteenth note.[205] Fundamentally, the piece does not make the same type of demands on a performer as *Sounds and Words.* Given Babbitt's extensive use of the synthesizer in 1958-59, it seems very likely that composing in this new way affected his vision for serial possibilities, and reflects the desire for increased control of the temporal domain. As the electronic medium was unencumbered by performance limitations, the increased difficulty of *Sounds and Words* is a logical consequence.

Given the complicated rhythmic system seen in *Sounds and Words*, we might wonder how a performer would fare at realizing the work. The best known recording is a performance by vocalist Bethany Beardslee and pianist Robert Helps. Both performers' collaborations with Babbitt and other 20th century composers are celebrated, and with good reason. Consequently, examining their performance of the work is instructive.

In understanding the performance aspects of this work, we must answer the question: how crucial is it that a performance of this (or any other total-serial work) be realized

205 Mead, 116-117.

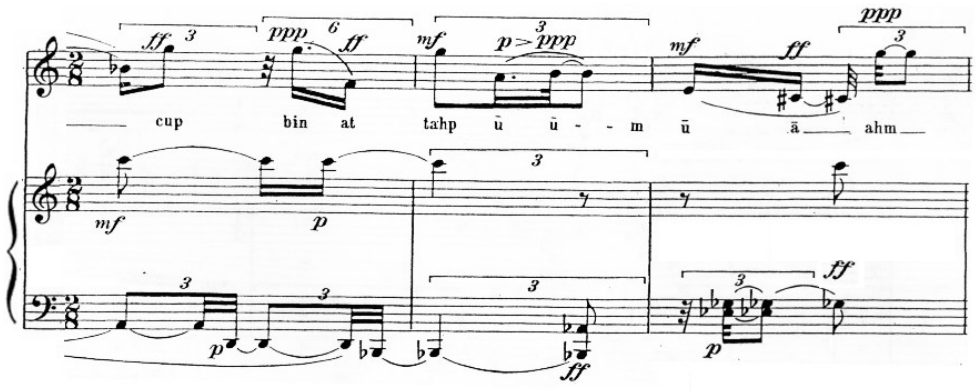
absolutely accurately? This is a complicated question; he clearly explains his view of the significance of accurate performance in “Who Cares if You Listen?” (quoted earlier). If, as Babbitt seems to be saying, a reflection of the structure of the work is crucial to a quality performance, then any deviation from the score has grave implications. Under this formulation, mistakes in any realm would “falsify” the work. This being the case, a move to fully controllable, electronic media would seem to be the only option, particularly if performances are crucially inaccurate. Also, it seems reasonable to conclude that if Beardslee and Helps (two of the most able performers of difficult, modernist music in the world at the time) have trouble with an accurate performance of this work, then it is hardly an indictment of their performance abilities. Rather, it would reveal either a practical compositional problem with the work's difficulty, or a conceptual problem with the idea that the work's musical meaning lies in the accurate performance and perception of its serial structure. How “correct” (to use Babbitt's above terminology) is their performance?

From the outset, it must be noted that they do not keep the marked tempo throughout the work; they perform it in 2'53" rather than the expected 2'36". Despite this, as long as the proportions between sections were kept steady, then the fundamental aspects of the duration-to-pitch interval mapping would remain sound. Unfortunately, their performance does not manage this; tempo fluctuates throughout their rendering, so that while they do a commendable job of keeping the nine-second duration for the first block, their second block is truncated by one second (clocking at four seconds instead of five). This tends to be par for the course; though the quarter note is marked as remaining constant through most of the work, the performers tend to alter this when the time signature changes. That they do should not be surprising – even an excellent performer will have their internal clock rattled by

frequent shifts in the time signature, particularly in the way Babbitt does it (parsing a single measure of 5/8 into two blocks of sixteenth-note sextuplets, for example). These constant shifts in the modulus, combined with the lack of recurring stress pattern within individual blocks means that there is nothing in the composition that grounds the tempo. That Helps and Beardslee are unable to keep a steady 60 bpm tempo speaks not to their inability as musicians, but to the functional ametricality of the piece, and the consequential impracticality of performance of this type of duration structure, at least as Babbitt conceived of it at this point. It would show tangible reasons for why a turn to the total-control of the synthesizer was necessary.

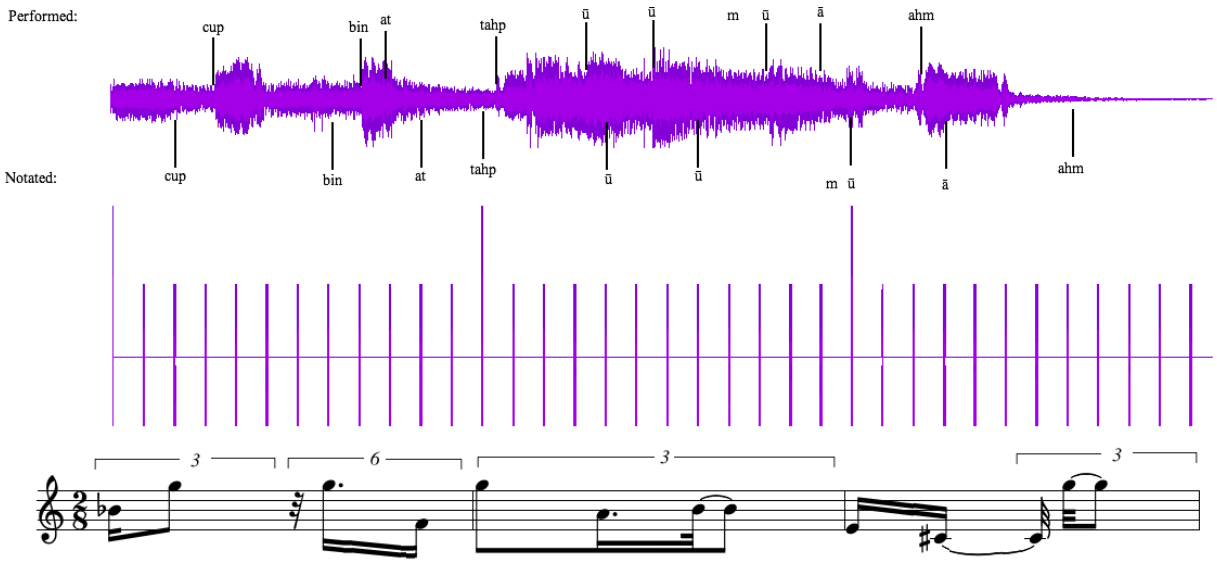
So, the large-scale duration structure is, to use Babbitt's terminology, "falsified" in this performance. How do they fare in the placement of individual time-points? As with the duration structure, the results are inconsistent. Predictably, the faster, more difficult parsings of the measure yield the most inaccurate results. Take, for example, mm. 22-24 (the final block of section 2), seen in fig. 2.15:

Figure 2.15 – mm. 22-24 of *Sounds and Words*



This passage should be performed in three seconds; Beardslee and Helps do it in four. Using their four second performance, I spaced a click track at the rate of the time-point unit, to better hear their placement. I then digitally slowed the tempo so that the whole passage was stretched to seven seconds. Below is a visual representation of this, annotated with the syllables as they are performed, as well as the syllables as they would be expected according to a strict interpretation of the rhythm (see fig. 2.16). As the analysis shows, Beardlsee does a commendable job at placing a very fast time point unit (clocking in at 720 TPU/minute) approximately correctly. However, if we were to interpret her performance as part of a time-point array, we see that it is quite different from that of the notated array (and this does not even take into account her interpretation of the dynamics, which is often rather imprecise). Again, we can only conclude that this performance "falsifies" the work's structure.

Figure 2.16 Annotated Analysis of Beardslee's Performance of mm. 22-24



None of this assessment is meant to impugn Helps or Beardslee. Nor is it meant as a criticism of the musicality of the composition itself. In fact, Beardslee's interpretation of the work is very musical and engaging, and I find the performance and piece quite beautiful. Furthermore, there were very few performers active at this time who had either the skill or inclination to even attempt to learn a piece of this difficulty. Rather, this analysis is meant to problematize Babbitt's conception of musical meaning in a serial work for live performers. If Beardslee cannot accurately reflect the time-point array in this organizational scheme, then it is not hyperbolic to say it is outside the realm of human ability, at least as far as reasonable expectations are concerned. We are then left with two possibilities: either the musical meaning communicated by a serial work in the manner of *Sounds and Words* is not communicated by the serial structure (and so some degree of imprecision is acceptable), or it is simply unrealistic to imagine that *any* performer could produce a version of this work that did not in some way falsify its musical meaning. Given Babbitt's thoughts regarding the musical structure he expresses in "Who Cares if you Listen," it is difficult to imagine that he did not view the serial structure as being crucial to the work's musical meaning, at least at the time *Sounds and Words* was composed. Consequently, it is easy to see why he turns to the electronic medium shortly after these works.

This does leave a few questions, however: first, if the serial structure of a work has to be accurately performed in order to convey musical meaning, why did Babbitt compose in a way that was impossible, or at least quite unfeasible, for a human to accurately perform? Second, why did Babbitt mostly give up composing in the electronic medium after a couple decades, especially given the premium he put on accurate performance? In answering the questions, it is helpful to look at *Phonemena,* which in many ways, represents a more

polished version of much of what *Sounds and Words* attempts to do.

D: Phonemena (1969/75)

Babbitt released versions of *Phonemena* for both soprano and piano (1969) and soprano and tape (1975). It should be noted that these are the dates of publication; 1975 was the date that a recording of synthesizer part (realized on the RCA Mark II) was made available by the publisher.[206] Consequently, we should not assume that the synthesizer version was a radical re-envisioning of the work – indeed, the same score is used for both versions, though it should be noted that the piano version cannot include the timbre serialization included in the tape version. Babbitt's realization of electronic versions of acoustic works has some precedent: *Vision and Prayer* (1961), for soprano and synthesized tape, was preceded by an unpublished (and likely, unfortunately, lost) version, composed in 1954, using piano in place of the synthesizer, which Babbitt states, "in a rather nebulous way . . . became the basis" for the electronic version.[207] There are two important differences between these cases, however – first, Babbitt composed *Phonemena* well after extensive work with the synthesizer, while at the time of the preliminary version of *Vision and Prayer,* he had not yet used the machine; second, in the case of *Phonemena*, the same score is used for both versions, while the earlier version of *Vision and Prayer* appears, from Babbitt's description, to have been quite loosely related to the published piece.

Almost every aspect of *Phonemena*'s serial structure comes across as a refined version of the organization and techniques in *Sounds and Words.* As noteworthy though, is the fact that Babbitt seems to have made great strides in improving the odds of accurate performance of

206 Kuehn, 3.
207 Babbitt, interview with Cole Gagne and Tracy Caras in *Soundpieces* (London: The Scarecrow Press, inc., 1982), 49.

the work's rhythms. *Phonemena* employs an all-partition array, in other words, an array that makes use of all seventy-seven possible partitions of twelve into twelve or fewer parts. The piece's row is based on the all-combinatorial hexachord (023457).[208] As with *Sounds and Words*, the synthesizer's lynes of the pitch array are articulated through register. *Phonemena* uses twelve lynes, six in the vocal part and six in the synthesizer/piano.[209] The all-partition array structure and all-combinatorial nature of the hexachord that forms *Phonemena's* row means that the pitch class array has a number of qualities that *Sounds and Words* lacks, in that its structure is a more complete exploration of the possibilities of the serial architecture. However, for the purposes of this study, the most interesting departures and developments we see in *Phonemena* happen in the rhythmic and timbral domains. While register projects pitch lynes in the piano/synthesizer part, Babbitt uses vowel phonemes to project pitch lines in the vocal part, with each line expressed by two related vowel pairs.[210] Below is Kuehn's reckoning of the vowel-pairs (see fig. 2.17). As the vowels are projecting pitch, the consonants are one of the controlling projectors of the time-point array.

208 Kuehn, 11.
209 Kuehn, 17.
210 Kuehn, 12.

Figure 2.17 – Lyne Projection Through Vowels in *Phonemena*, after Kuehn[211]

Lyne	Vowel Pair	Pronunciation	Quality
1	ē	beat	Bright
	i	bit	—
2	ā	bait	—
	e	bet	—
3	a	pat	Medium
	ah	pot	—
4	aw	bought	—
	ō	boat	—
5	u	put	Dark
	ū	boot	—
6	uh	but	—
	u	burn	—

There are practical reasons for this arrangement: given a standard vocal range, combined with the number of lynes required for Babbitt's all-partition array scheme, it would be somewhat musically limiting to assign lynes based on range for the vocal part (assuming a C4 to C6 range and the six necessary lynes, each lyne would be expressed in a band of a major third). Using vowels to project the lynes not only gives a bit more musical flexibility, it also allows timbre to be crucial to the projection of pitch, giving a more integrated serial scheme. As stated above, the significance of vocal phonemes extends to the rhythmic domain, as well. By using the two parameters of the vocal sounds (vowels and consonants) to project the pitch array and time-point array, the vocal part helps to unite the pitch and rhythmic domains.

Phonemena, like *Sounds and Words*, has a time-point array based on the pitch-class array. Rather than trying to unfold them concurrently (which, as we saw in *Sounds and Words*, creates practical problems for both performance and perception) Babbitt uses the a transformation of the pitch array under RT_{1}.[212] He is unconcerned with unfolding the pitch aggregates at the same rate as the time-point aggregates – pitch aggregates average roughly

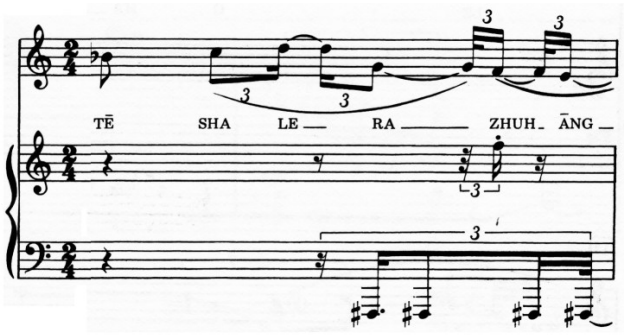
211 Kuehn, 17.
212 Kuehn, 21.

4.4 beats per aggregate, and time-point aggregates average roughly 5.7 beats per aggregate (this means that consequently, the time-point array does not complete the full 77 aggregates of an all partition array, instead only completing 59).[213] While this is a compromise, it is no more a deformation of the serial structure than Babbitt made in *Sounds and Words*, where two of the blocks abandoned the time-point array entirely because of the necessary pace of the time-point unit.

As with the pitch array, the synthesizer part projects the time-point array in tandem with the vocal consonants.[214] Babbitt employs four different time point units in *Phonemena*: the triplet 32nd, the 32nd, the septuplet 16th, and the quintuplet 16th.[215] This has some ramifications for performance practice: *Sounds and Words* necessarily utilized twelve different time-point units in order to create the large-scale structure. This rapidly shifting modulus is the primary reason for the work's rhythmic difficulty and metric opacity, and by abandoning this aspect of serialization, Babbitt creates something far more performable. Furthermore, the accompaniment and singer inevitably have synchronized modulus units, so in the tape version, the synthesizer part accurately models the rhythmic unit for the singer in any given measure. Babbitt makes a habit of putting guide-points in the tape part that allow the vocal part to synchronize during the sections with the most difficult time-point units (the 32nd note triplets) – see, for example, m.2 (fig. 2.18), where the Babbitt facilitates the placement of the "Zhuh" syllable with the help of an octave doubling in the tape.

213 Kuehn, 24.
214 Kuehn, 21.
215 Kuehn, 24.

Figure 2.18 – Synchronization of Rhythm between Tape and Singer in *Phonemena*



The timbral aspects of Babbitt's serialization in *Phonemena* are complicated by the fact that the accompaniment can be played by either tape or piano, and the piano does not have the same timbral capabilities as the RCA synthesizer. Assigning a structurally crucial aspect of the work to a part that might be incapable of expressing it means that would seem that either some aspect of the work is potentially "falsified," or Babbitt had changed his opinion on the musical importance of structure in the years since the 1958 article. In spite of this, he does make a significant effort to tie the tape's timbres to the vocal line. Babbitt assigns two related formant filters to each hexachordally combinatorial lyne pair, which creates a parallel to the pitch-array-projecting vowel formants in the vocal part.[216] At the same time, other timbral settings control the tape-portion of the time-point expression.[217] In his analysis, Kuehn is a bit unclear regarding how these different timbre settings interact with one another. Babbitt combines the preset formant filters for hexachordally combinatorial lyne pairs with other timbral settings for the time-point system, but Kuehn notes that the time-point system is especially hard to follow, since separate lynes are freely interspersed between vocal and tape/piano parts.[218] The combination of different timbres makes decipherability challenging, and it is difficult to parse the timbre-reliant time-point system even with a schematic of the

216 Kuehn, derived from a conversation with Babbitt in 1995, 23.
217 Kuehn, 21.
218 Kuehn, 24.

array structure. This arrangement does, however, allow Babbitt to project most given time-points with the voice or tape, allowing for musical flexibility at the expense of a more comprehensible time-point scheme.

It is perhaps unexpected that *Phonemena,* a piece which actually uses electronics, is less rhythmically complex than *Sounds and Words*. I believe that this is the result of Babbitt's experience with the results of *Composition for Tenor and Six Instruments* and *Sounds and Words* – pieces that seem to have been conceived during a period of intense experimentation on a medium where issues of performability were of no concern (a classically theory-driven, Mode 1 endeavor). In discussing *Composition for Tenor and Six Instruments*, Babbitt said: ". . . in many ways it was my most difficult piece both to perform and to hear. . .I decided after that piece that I would have to find some sort of way of writing music that was not as difficult. It was just too much.[219]" Given how much more rhythmically difficult these 1960 works are than those immediately preceding, it seems plausible that the two years experimenting with the synthesizer affected Babbitt's conception of rhythm and meter, and the first (acoustic) works he wrote after his initial experiments did not take into account the fact that performers need something to latch onto in order to accurately realize rhythms, be it a repeating metric structure, or intrinsically accurate guideposts (as in fig. 2.18). Babbitt's above comments make it clear that he understood the model would need to be changed somewhat: while the time-point system persists and is further developed, it had to be used in a way that was performable. This was of no concern for the purely electronic works (beginning with *Composition for Synthesizer* in 1961), and consequently these works feature rhythms and techniques no human could reasonably hope to accurately reproduce. For works

219 Babbitt, quoted in Bernstein, 48-49.

involving humans, however, Babbitt could employ the synthesizer as simultaneously as an organizing principle and as a guide to ensure accurate reproduction on the part of the performer, as he does in *Phonemena*.

Phonemena is one of the final works for electronics Babbitt released.[220] Its time-point system still employs temporal divisions that appear challenging to hear and perform, but by abandoning the large-scale duration serialization of sections that he used in earlier works, Babbitt is able to have more consistently recognizable modulus units. This has the effect of making the work more performable, and probably, more perceivable as well.

In works like *Philomel,* Babbitt creates a tie between vocalist and synthesizer by using the synthesizer's processing capabilities to link the timbres of the vocalist and accompaniment. *Sounds and Words* achieves this link through the serial architecture itself, without electronically processing the vocal part. This has important implications for the possibilities of serializing timbre. Examining *Sounds and Words* in the context of this later work certainly makes it seem almost prototypical. In many ways, Babbitt's first published works for the synthesizer were acoustic.

E: Significance and Abandonment of the Medium

Bernstein positions *Composition for Tenor and Six Instruments* (and, presumably, its companion work, *Sounds and Words*) as "something of an end-point for Babbitt."[221] The difficulties with performing these works necessitated a change of direction. He continues, "Either … he would have to change his compositional practice or turn to electronic synthesis,

220 As mentioned above, the tape was released in 1975, while the piece was composed in 1969. It is unclear exactly when the tape version of the accompaniment was realized, but Mead's catalog of compositions lists only two subsequent works that used electronics: the *Concerti* (1976) and *Images* (1979).

221 Bernstein, 48.

and in the years following the composition of *CT6* he would explore both options."[222] There is certainly some truth to this, as we have seen. But these works are a something of a starting point as well. They are his first works using the time-point system, which would come to dominate the rhythmic practice of much of his second period, and as I've noted, Babbitt's use of the synthesizer extends back to at least 1957, which must have informed his compositional practice well before his first published work for synthesizer in 1961.

Given the advantages that the electronic medium has in realizing intricate, hyper-controlled rhythmic and timbral parameters, it is natural to wonder why Babbitt turned away from electronic composition in favor of acoustic. After intense experimentation with and composition for the RCA synthesizer in the late 1950s and early 1960s, his works for the medium become more sporadic. By 1980, he had entirely ceased composing for the electronic medium. There are a number of reasons for this: primarily, the RCA synthesizer was rendered inoperable by vandals after a break-in in 1976.[223] Babbitt's electronic practice was so closely entwined with the synthesizer, that it seems he did not feel it was worthwhile learning how to work in another environment. This is his claim in a 2002 discussion panel, when asked about electronic music:

> No, I haven't worked in this medium for 27 years. Since the synthesizer is no longer possible because it was rather badly destroyed by some vandals (you see, there is justice in the world) I haven't done any electronic work. Nothing can substitute, for me, for the synthesizer, which was my baby, and my poor little baby is no more.[224]

222 Bernstein, 450.
223 Nick Patterson, "The Archives of the Columbia-Princeton Electronic Music Center," in *Notes* 67, no.3 (March, 2011), 484.
224 Milton Babbitt and James Romig,"Two Discussions with Milton Babbitt, (2002)," http://www.jamesromig.com/uploads/5/6/2/5/56250769/babbittdiscussions.pdf (Accessed 3/1/17).

Still, this seems odd, given how important it would seem Babbitt believed a faithful performance was to the musical value of his works, and how the electronic medium would seem to be a very good solution to problems of faithful realization of the score. If he was going to be ultimately reliant on human performers, it would stand to reason that he might have adjusted his practice based on his observation of human perceptual and performance capacity, and there is some evidence to show that is the case. In the same 2002 discussion panel (referenced above), Babbitt speaks of the limits of human performance:

> Harvey Sollberger -- who was, at that time, I would insist, the best flutist I'd ever known -- came to the studio once, and I played for him a trill that was actually 35 alternations a second. He listened to that, and said "well, I can play that," and he simply got his flute and he tried it: he couldn't come close. He could only trill at half that speed. But the reason he thought he could do it was because he could perceive it so easily. I mean, if you could hear that differentiation -- I remember it was a C to a D 35 times a second -- he could hear the pitches; of course he thought he could do it. But it was physically impossible: 15 alternations a second is about the limit of the muscular system.[225]

This shows that Babbitt was at least aware of mechanical human limitations in performance. However, this does not seem to have extended to a true understanding of perception as it intersects with performance. Yes, we can perceive two distinct pitches played at a rate that outpaces human muscular capabilities. But in a passage where a one-second time span is divided into twelve equal parts, it is not clear that we have the perceptual capacity to meaningfully differentiate a sound event on the seventh vs. eighth attack point – particularly in the context of a constantly shifting modulus. On this point, the performer and audience member are united: the performer will have difficulty playing it, because, like the audience member, the difference is not perceptually meaningful. Babbitt seems to attach a large part of a work's musical meaning to this difficult-to-perceive parameter, which, if capable of being performed, would be justified. There is nothing wrong, artistically, with

225 Babbitt and Romig, 7.

focusing on these parameters, but if the work is hopelessly impractical to perform or perceive accurately (as seems to be the case with *Sounds and Words* and *Composition for Tenor and Six Instruments*), this formulation becomes acutely problematic. It also is naturally going to limit audience appeal – for Babbitt, this was but a small issue to overcome (his assessment of the "Composer as Specialist,"the original title for "Who Cares if you Listen," reads as an attempted explanation and justification of the limited audience). For RCA, however, this is a more fundamental problem, and calls into question Babbitt's usefulness as collaborator in a Mode 2 paradigm, at least as it relates to creating something marketable.

That Babbitt's subsequent work for human performers seem to be less rhythmically demanding would suggest that he at least tacitly acknowledged the limits of perception, but only came to this conclusion after seeing the results of *Sounds and Words* and *Composition for Tenor and Six Instruments*. By the time Babbitt was releasing polished works for the synthesizer plus performer, he had already realized the limits of human performance, though his rhetoric surrounding this issue tends to imply unwilling, rather than unable performers.

There are, perhaps, some additional factors that affected Babbitt's decision not to pursue other avenues of electronic composition. Curtis Roads points to a number of reasons that may have fed this decision: the first is that there simply were not many technical equivalents to the RCA synthesizer in 1976 – Babbitt was already 60 years old, and perhaps was unenthusiastic about investing the time necessary to learn yet another technology with a cumbersome interface; the second is that there may well have been cultural factors at work, in that acoustic instruments were respected more generally than tape music (or indeed any music played over loudspeakers) within Babbitt's circle.[226] Babbitt's own comments do seem

226 Curtis Roads, e-mail message to author, July 14, 2017.

to suggest that attitude. Discussing recording in a 1987 interview with Bruce Duffies, he says:

> For all the electronic composer that I have been, and perhaps may be again — though that's a purely practical matter — for all of my involvement allegedly in technology and, God be with us, mathematics, which of course is totally, totally misunderstood, I don't like recordings that much! There's no substitute for a really good live performance. Just the dimensionality of it; just the separation; just the possibility of being able to differentiate and hear things that simply cannot be conveyed by even the best recording.[227]

Perhaps Babbitt felt that the very technology that allowed for such precision in composition inevitably led to the muddling of perception. As long as Babbitt could create a system that was performable by a competent musician, he could reap the benefits and dynamicism of live performance.

Assessing the significance of the synthesizer to Babbitt's compositional output is a bit complicated, as our observations point in a number of directions. On one hand, Babbitt's relationship with the RCA Mark II was such that, after it was rendered inoperable, he never worked in the medium again. This suggests that, at least by 1987, the medium was not actually that important to him. However, the circumstances of the development of time-point seems to directly tie his system of rhythmic serialization to his time spent learning and composing for the synthesizer. Furthermore, the synthesizer's timbral manipulation system seems to have opened up new avenues of methods for timbral serialization. In this context, the trajectory of *Sounds and Words* to *Phonemena* shows an adjustment for how to serialize the most salient musical parameters, while at the same time reconciling the possibilities of total control and literal reproduction with the capabilities of human performers (whom Babbitt seems to have ultimately preferred). The idiosyncrasies of the RCA synthesizer's

227 Milton Babbitt, Interview by Bruce Duffie, "Composer Milton Babbitt: A Conversation with Bruce Duffie (1987) ," http://www.bruceduffie.com/babbitt.html (accessed 3/1/17).

input system are inexorably linked with this conception of time and the struggles with performance that this conception engenders, as well as with a categorization of timbre most naturally controlled using phonemes.

The significance of the synthesizer for RCA is easier to assess: by any reasonable metric it was a loss for them. However, it is not unusual for companies of the size of RCA to have dead-ends in their research and development processes, and the overall cost for the machine, anywhere from $250,000–$750,000[228] is a drop in the bucket when compared with their 1959 net profits of around $40,000,000.[229] and the fact that the synthesizer was a multi-year project means that the cost was even further defrayed. During the development period of the synthesizer, RCA was pursuing a number of possible projects; some, like color televisions, would go on to be wildly successful. Others, like the synthesizer, would prove to be failures. The project does show that RCA, at least initially, felt that the project had potential, though since most information we have available about the development comes from Columbia-Princeton sources, it is difficult to identify what RCA believed the nature of that potential to have been. One might imagine that had the project been a resounding success, with an RCA synthesizer at every university, RCA would have publicized the story a bit more.

Why was the project a dead end for RCA? In many ways, the aspects of the device which so enticed Babbitt also made the device unintuitive and un-musical, at least in the way in which music is more widely conceived. The lack of a keyboard for an input method and a programming system that required a very idiosyncratic conception of musical time, in combination with the laborious nature of the task of inputting a complete work (on account

228 Babbitt, in a 1968 interview with *Music Educator's Journal*, wrote that each Mark II synthesizer cost "a quarter of a million dollars," and I have found unsubstantiated, uncited reports that the initial development process cost $500,000 – hence the range.

229 *Wall Street Journal*, "RCA Says Profit Rose 29% in 1959 on 17% Sales Gain," Dec. 30, 1959.

of the level of control the operator had over all aspects of the sound), meant that the RCA synthesizer was never going to be widely adopted by musicians – even those interested in electronic music. Had the engineers Olson and Belar sought more widespread council from composers (and musicians in general), the impressive technologies employed in the synthesizer could have been presented in a more workable context, and RCA might well have not shelved the project. I do not believe that it is coincidence that the other case studies in this dissertation, which I assess as more fruitful for the private company involved with the creation of the studios, both feature wider collaborations than did the creation of the RCA synthesizer.

Significantly, the dead-end results of RCA's synthesizer program meant they likely had little interest in pursuing this technology further. Only a few years later, with the advent of voltage-controlled modular synthesizers, pioneered by Robert Moog, synthesizers became more widely used an available, and could well have been a profitable avenue for RCA. The *Music Educator's Journal* sums this up well in 1971:

> No longer is the electronic music synthesizer solely for the large university or avant-garde composer. Since the beginning of 1969, a number of new synthesizing machines and systems have come on the market, apparently due to the sudden realization by manufacturers of the commercial potential of electronic music.[230]

The failure of RCA's synthesizer project should be assessed in light of what could have been for the company. Given the commercial potential for synthesizers, RCA's effort and ultimately failed development process was certainly a missed opportunity – one that other companies in this study did not make. As we shall see, for Mode 2 collaborations to be truly successful for all parties, the company must have a clear-eyed vision for the project (as Siemens did), or at least solicit opinions from a diverse array of collaborators (as Sony did).

230 Robert C. Ehle, "Synthesizers, Anyone," in *Music Educator's Journal* vol. 57 no.5 (Jan. 1971), 78.

Fundamentally, RCA's synthesizer project imitated Mode 2 knowledge production superficially, but was actually an exercise in theory-driven, Mode 1 insularity. What was a fruitful compositional tool for Babbitt was of no use to RCA.

III: Mauricio Kagel and the Siemens Studio for Electronic Music

While it only operated for roughly a decade, the Siemens Studio for Electronic Music is an instructive example of the Mode 2 paradigm at work: it was established for a specific application, and was the product of a number of specialists working in collaboration. The studio was created for (and ultimately fulfilled) an extraordinarily narrow goal, but it successfully served other purposes, and a number of composers made use of the studio's state-of-the-art equipment and facilities. Its dissolution was more a result of an internal power struggle and accompanying change of priorities than an indictment of the project's profitability. In spite of the rather limited application at the heart of its genesis, the studio would prove to be influential in the history of electronic music, with its technological achievements laying the groundwork for later electronic studios, and the studio itself serving as an important location in the creation of *Antithese*, an under-appreciated yet highly significant work in the artistic development of Mauricio Kagel.

A: Siemens at War and The Pulse of Our Time

In 1955, the Siemens company had rebuilt its electrical engineering capabilities into a force comparable to its prewar incarnation, and sought to promote its services to a broad, multinational audience.[231] To this end, they commissioned a promotional film, *The Pulse of Our Time*, "a full-length color film with music,"[232] devoted to exhibiting their cutting edge technology and global reach. Though it was a promotional industrial film, it was a major undertaking and achievement, with Siemens's filmmakers traveling to four continents, and the film eventually receiving the Federal German Film Award and gold ribbons at the tenth

231 Alexandra Kinter, "News October 16, 2009 – 'Impulse of our Time' premiere 50 years ago," *Siemens History*, October 16, 2009 (accessed 6/24/15), https://www.siemens.com/history/en/news/impulse_of_our_time.htm.

232 Kinter (accessed 6/24/15).

Berlinale in 1960.[233] Siemens's commitment to the film carried through to its soundtrack. They initially enlisted Carl Orff as music consultant, but he declared the film "fit no 'natural' music," but only 'technical,'" (apparently meaning electronic) and recommended his pupil, Anton Riedl, compose the music.[234] The Siemens management committed fully to this "technical and musical experiment,"[235] and embarked on developing an entire electronic music studio, solely (at least at first) for the purpose of supplying music to their film.

It may seem peculiar to devote so many resources to a promotional film. To understand this course of action, we must understand Siemens behavior, both during World War II and immediately following. In *West German Industry and the Challenge of the Nazi Past, 1945-1955*, S. Jonathan Wiesen uses Siemens as a case study of a German company that used slave labor and profited from its time under the Nazis.[236] Allied victory was profoundly traumatic for the company, for a variety of reasons. First, Siemens was headquartered in the portion of Berlin occupied by Soviet forces, and consequently, their main factory was almost entirely plundered by Russian troops – of the 23,100 machines in their Berlin site, the Soviets took 22,700 back to Russia, and most of the higher-level managers either fled to other parts of Germany, disappeared, or were killed.[237]

The material losses to the company were, naturally, catastrophic. But an even more lingering difficulty would prove to be the company's conduct during the war. Occupational governments took a dim view of corporations that thrived during the Nazi regime, even as they recognized the necessity of quickly reconstructing the German economy to be a bulwark

233 Kinter (accessed 6/24/15).
234 Beate Hentschel, Liner Notes, *Siemens Studio für Elektronische Musik*, trans. Jurkowski and Levy, Audiocom Multimedia, 1998, compact disc.
235 Hentschel.
236 S. Jonathan Wiesen, *West German Industry and the Challenge of the Nazi Past, 1945-1955* (Chapel Hill: University of North Carolina Press, 2001), 23.
237 Wiesen, 21.

against the Soviets. Luckily for Siemens, the British (in whose quarter of Berlin the *Siemensstadt* was located) were less severe than the Americans in this regard.[238] Even so, there were serious issues regarding Siemens's conduct during the war for which company heads had to answer. Siemens benefited directly from using forced Jewish labor in the company's factories – from 1940 to 1943, 2,000 Jewish workers toiled for Siemens, most of whom were gassed immediately upon their arrival at Auschwitz after the German "resettlement" plans went through.[239] In the later stages of the war, the company set up workshops in the Bobrek subcamp of Auschwitz, as well as the Ravensbrück camp, where forced 2,300 prisoners to work for the company, in the harshest of conditions.[240] Furthermore, Siemens would have a hard time arguing they were not war-profiteers, since by mid 1943, 80% of their products were being sold to the Wehrmacht.[241]

The leadership of Siemens was keenly aware that to the new occupying government, these activities looked very bad, indeed. In early 1945, shortly after the close of the war in Europe, Siemens board-member Fritz Jessen prepared a memorandum titled "On the Question of the War Criminality of Siemens." which was designed to detail a strategy to fellow board members for how to confront allegations of war criminality. Wiesen describes it as a "combination of truths, half-truths, and inaccuracies,"[242] but it nonetheless provided an outline for the approach that Siemens would take in crafting the narrative for their conduct during the war. In July of 1945, the company started on a series of documents disavowing ties to the "Hitler regime," defending their behavior, and making their case for their value to

238 Wiesen, 42.
239 Wiesen, 22-23.
240 Wiesen, 23-25.
241 Wiesen, 29.
242 Wiesen, 30.

the reconstruction effort.[243] The board carefully crafted these documents, and circulated them to potential sympathetic captains of industry in the United States.[244] The extent to which these company efforts were successful is debatable, since the company's own workers ultimately turned on the board of directors during de-Nazification proceedings in 1947. However, the British-led occupying government eventually exonerated the board members,[245] and the company was able to finally tone down their publicity efforts. Even so, for a number of years after the war the board feared that the company would be broken up, or board members persecuted, and it's reasonable to believe that this episode in their history had a lasting effect on how the company viewed itself.

Siemens was consequently deeply invested in constructing the company's modern identity, including a sustained and concerted effort to twist the facts of their wartime conduct and define themselves as put-upon victims, trying bravely to work within the confines of an unfriendly regime. *The Pulse of our Time*, I believe, is an extension of this effort, and so is more than just a mere promotional film. If the voluminous memoranda and reports Siemens prepared in order to defend their conduct under Nazism was phase one of a redefinition effort, this was phase two; by 1955, enough time had passed that the most overt scrutinization of the company's Nazi ties had passed, and they had rebuilt their industrial capacity to the point that they could dictate to the rest of the world their company identity. This film would be the capstone to the company's efforts at redefinition.

243 Wiesen, 30-31.
244 Wiesen, 40-41.
245 Wiesen, 47.

B: The Studio

Siemens designed the film to exhibit their electrical engineering capabilities, and so it seems natural that the development of an electronic music studio would be an extension extension of their engineering goals. The first equipment in the studio reflected the technicians' engineering interests and Siemens earlier projects: Siemens engineers Helmut Klein, Alexander Schaaf, and Hans Joachim Neumann were the engineers in charge of assembling the studio, and had all worked on projects with telecommunication applications.[246] Klein had developed the Siemens vocoder (which was based on Bell Labs patents),[247] and Neumann had just finished his doctoral thesis on bell spectra.[248] That the centerpiece for the studio was an advanced vocoder, which consisted of twenty band-pass filter channels tuned to different frequency ranges.[249] Additional sound processing equipment included modules for reverb and echo, as well as a pitch shifter, which seems to have been essentially a flexible ring-modulator.[250] Sound generation consisted of an amplified 84-tone reed instrument known as a Hohnerola, 20 sine-wave generators (which could also be switched to saw-tooth generators), and a white-noise generator.

When Riedl was brought on as a composer-consultant, he sought to add a measure of control over programming similar to that of the RCA synthesizer.[251] To that end, the engineers added a punched paper-tape input system with parameters for pitch, volume, timbre (based on band-pass filters) and duration (which was based on note lengths, rather than attack points). The interface was less cumbersome than the RCA synthesizer in two

246 Holmes, 157.
247 Holmes, 158.
248 Henschel.
249 Holmes, 158.
250 A ring modulator adds both the sum and the difference of the carrier wave and the modulating wave – the Siemens pitch shifter allowed for either the sum or the difference, or both.
251 Holmes, 159.

important regards: there was a measure of automation to the settings, and the setup also allowed a composer to play a note on a piano keyboard before recording it as a hole in punched tape. Overall, the interface was a good deal more user-friendly than that of RCA's offering.[252]

The end result of the collaboration produced a sophisticated studio whose initial purpose was entirely devoted to the composition of a single documentary soundtrack. It was an endeavor clearly designed to present Siemens as a forward-thinking, global technology juggernaut. The film is rather remarkable in that, outside of a few lines of dialogue, the sound employed in the film is entirely either narration or Riedl's score. The narrator dictates what we are seeing and how we should see it.

In the film, Siemens's production facilities are presented as automated and sleek, and there is no grime or machines belching smoke. These scenes are juxtaposed with clips of German engineers overseeing construction projects and the extraction of raw materials in a variety of countries (Mexico, India, Saudi Arabia, Nicaragua, and Afghanistan, among others). Clips of bourgeoning Siemens-led technology are juxtaposed with the denizens of these developing countries themselves, often using traditional methods of construction and transport: people bearing fill dirt away on their heads from a construction site, or heavily-leaden camels walking around a modern dam. As the film progresses, we see citizens of some of these countries making use of modern technologies. The narration typically focuses on a simple explanation of the scenes, but the subtext is clear: through the power of technology, Siemens is civilizing the Third World.

The accompanying sounds of all this are neither that of heavy industry, nor stereotypical,

252 Holmes, 159.

locale-inspired music – they are Riedl's score. Siemens is creating the future, and the soundtrack to this vision of the future is an abstract electronic soundtrack. With very rare exceptions, the soundtrack functions independently from the action on screen; sound is not subordinate to image, and there is almost no diegetic sound in the film. The musical material is at times motivic, and at times angular and more abstract. In general, it seems like Riedl tries to evoke the buzzing, twanging, and humming of what the machinery of the future *might* sound like, though as mentioned above, this is generally divorced from a sense of real cause and effect regarding the actual equipment in the film.

This score attracted attention from a number of composers, many of whom would visit the facilities (though few would realize important works there). Given the costs of developing the expertise and equipment, it seems curious that Siemens had little plan for the studio beyond the music for their film, at least initially. It was only in 1963, years after the film's premier and shortly before they made a charitable donation of the studio (a few months later), that Siemens codified their vision for it, releasing the following statement:

> Every age has produced its characteristic music, formed from the same forces that have shaped this era. In our technological age, music is confronted as an art form with the forces of technology to a hitherto unknown extent. The answer is a new art form, a synthesis of music and technology: electronic music.
>
> The purposes of the studio are:
> a) To give composers the opportunity to create new works (autonomous electronic music).
> b) To rent the studio out to interested parties for recording applied electronic music in connection with film, television, theater, etc.
> c) To develop the apparatus on the basis of experience.[253]

253 Hentschel.

Siemens second listed goal, renting the studio out for commercial purposes, seems to have been fairly successful: the bulk of the forty-four works Riedl produced in the studio were for motion pictures and industrial films.[254] The studio operated at a profit, even as Siemens sought to hand it over to a charitable foundation; Siemens's last statement on the studio projected operating costs at DM 87,500 per year, and at 1963, had received orders earning roughly DM 96,000 per year (it should also be noted that during this time, the studio was functioning at only 50% capacity).[255]

Regarding their first stated goal, the Siemens studio had a clear advantage over some of the other large studios of the time, such as WDR Cologne: as far as musical and aesthetic ideology, it was unaligned. Makoto Mikawa articulates this well in his dissertation, "Anarchy in the Unity: Mauricio Kagel's *Antithese*": many studios were developed to serve a particularly ideological bent – for example, Meyer-Eppler's study in phonetics and communication research informed WDR Cologne's development of their facilities, which developed an ideological and aesthetic rivalry with Pierre Schaefer's *musique concrète* studio. In the case of Siemens's studio, theory and method of composition was very much in a secondary role, and so had no studios they were competing with, at least in terms of theory, aesthetics, and ideology. There was no need to toe a party line.[256] This is probably largely a result of Riedl's own non-partisan stance: he worked extensively in both *elektronische* and *concrète* environments,[257] and that aspect of the studio was attractive to composers like Mauricio Kagel, who consciously tried to distance himself from the polemic between

254 Holmes, 159.
255 René Spitz, *HFG Ulm: The View Behind the Foreground* (Ulm: Axel Menges Press), 2002, 324.
256 Makoto Mikawa, "Anarchy in the Unity: Mauricio Kagel's *Antithese*," doctoral dissertation, University of Western Ontario, 2012, 97.
257 Mikawa, 102.

elektronische Musik and *musique concrète*.[258]

Given the time and energy that Siemens spent in developing the studio, as well as its apparent profitability going forward, Siemens's decision to make a charitable donation of it after only a few years of operation is curious. Beata Henschel describes the reasoning:

> Even if the Siemens company, next to its intrinsic operations, was always aware of cultural work, the company director decided in 1963 that such a wide reaching cultural-political mission was outside the scope of Siemens, and that it would be more efficiently fulfilled in a charitable foundation for the development of electronic music.[259]

The time between Siemens's letter codifying the studio's purpose and the decision to liquidate its stake was under a year, and this probably indicated a lack of broader vision for the studio. Perhaps they felt that even though the studio had profit potential, developing and maintaining it on spec was not worth the opportunity cost. Perhaps paradoxically, though, in many ways the establishment and dissolution of the Siemens studio seems to perfectly exemplify the Mode 2 paradigm at work: the company had a narrow application for which it needed a solution (creating electronic music for an avant-garde promotional film.) Once that goal had been reached, the company could reassign its resources to the next task. The contrast between this and the RCA synthesizer project is marked: RCA never articulated a clear mission for the project, so the team of collaborators tasked with its development ended with a product geared towards their own interests. For RCA, there was no settled application for the synthesizer, at least as far as the company was concerned.

Siemens attempted to convince the Bavarian Ministry of Culture to establish a foundation to take over the studio, but the appeal was rejected, and Bavarian Radio also declined.[260] The Geschwister-Scholl Foundation, to be included as part of their expansion of the Ulm School

258 Mikawa, iii.
259 Hentschel.
260 Hentschel.

of Design (Hochschule für Gestaltung Ulm), which the foundation ran.[261] The Geschwister Scholl Foundation was set up after the war in recognition of members of the White Rose, an anti-Nazi resistance movement. Siemens seems to have been anxious to have someone else run the studio, while at the same time still developing new technologies which it could employ there, and the anti-Nazi connotations of the Scholls could only have been a bonus. They wrote to the Ulm School of Design:

> Siemens feels it is important that the HfG continue developing the equipment technically in close cooperation with Siemens itself, that there be the possibility of research in related fields (psychology, physics, etc.), and that opportunities for sound recording in the areas of film, radio, and television continue to be fully explored.[262]

Such an arrangement would have been highly beneficial for Siemens, who could have continued to work in collaboration developing technology (and, depending on the potential terms of the agreement, perhaps earned a cut of profits made from the studio) while at the same time keeping their maintenance and employment costs down. Unfortunately for Riedl, who stayed on as director, the Geschwister-Scholl Foundation does not seem to have been particularly interested in Siemens vision of collaboration. The acquisition of the studio appears to have largely been a chip in an in internal power struggle regarding the direction of the Ulm School of Design among the leaders of the Foundation, which had reached its zenith in 1963. One of the board of directors, Thorwald Risler, sought to use the studio as an opening to change the organization of the school, and so conducted the negotiations for and acquisition of the studio unilaterally. This resulted in a vote of no-confidence from the rest of foundation's inner senate in November of 1963.[263] Amidst this persistent bickering, work at the studio continued until the Geschwister-Scholl Foundation disbanded it in 1966.[264] The

261 Spitz, 324.
262 Spitz, 324.
263 Spitz, 324.
264 Hentschel.

School of Design was reorganized, and the studio was incorporated into the film school, effectively organized out of existence administratively, and sat unused until its acquisition and renovation by the Munich Deutsches Museum in the 1990s.[265]

Though few composers realized important works at the Siemens studio, it does seem to have had some impact on the direction of electronic music facilities. Pierre Boulez, who had toured the facilities, later recalled:

> When I visited this studio in Munich, it was the first time I saw equipment in which automation played a role; It seemed to for me to be so critical for the future. Automation and data control – these are what I regarded as indispensable a few years later. First, it was the early failed project of the Max Planck Institute of Music, then, the realization of IRCAM. But I think that it was the visits to Munich that gave me the initial impulse.[266]

Additionally, some of the studio's more specialized equipment would influence later creative ideas in electronic music. For instance, the studio was eventually equipped with an optical reader which could convert graphic images into tones and volume settings – this would in turn inspire the creation of electronic music from drawings and paintings.[267] The punched paper system, represented a marked improvement over the RCA synthesizer's similar system (particularly in its capacity to automate some parameters), and the ability to store a composition in a practical medium other than magnetic tape was a significant achievement.

It is worth examining one of the most substantial works produced at the studio, *Antithese*, by Mauricio Kagel, in order to understand the musical and multimedia possibilities that the Siemens studio offered. *Antithese* exists in two final forms: one for a single actor and electronics,which represents a unique vision for the possibility of performance within (arguably) the least performative medium of avant-garde music; the other, a filmed version,

265 Hentschel.
266 Pierre Boulez, Liner Notes, *Siemens Studio für Elektronische Musik*, trans. Jurkowski, Audiocom Multimedia, 1998, compact disc.
267 Holmes, 159.

representing something of an idealized theatrical version, which focuses on aspects of visual and audial discontinuity.

C: Kagel's Compositional Trajectory and Road to Munich

There are a number of reasons that the Siemens studio perfectly fit Mauricio Kagel's compositional trajectory when he went to the Munich studio in 1962. Before we examine *Antithese,* it will help to understand how his influences, from his early development in Buenos Aires to Cologne, helped to shape his compositional aesthetic and philosophy, and show *Antithese* to be very much a culmination of these influences, as well as piece that well represents much of what Kagel would explore in his music going forward.

Mauricio Kagel's earliest experience with electroacoustic composition came during his association with one of Buenos Aires's new music groups, the Agrupación Nueva Música, a group he joined after failing his entrance auditions at the local conservatory in Buenos Aires in 1947.[268] According to Hugh Davies, Kagel produced two electroacoustic sound studies (*Ion* and *Registros Sonoros*) in the early 1950s at the local recording studio, but these efforts have been lost.[269] He was able to read Pierre Schaeffer's treatise, *A la Recherche d'une Musique Concrète* (1952),[270] thanks to the extensive library of Juan Carlos Paz (the founder of Agrupación Nueva Música). Later, in 1952, Kagel premiered one of the first examples of *musique concrète* outside Paris, *Música para la torre* (Music for the Tower), a piece that was broadcast on speakers mounted on a forty-meter steel tower constructed by architect César Janello.[271] The piece's *concrète* component was four hours of industrial noises and

268 Björn Heile, *The Music of Mauricio Kagel* (Burlington: Ashgate Publishing, 2006), 8.
269 Davies, quoted in Makato, 39.
270 Makato, 38.
271 Heile, 14.

electronically-altered instrumental sounds,[272] and the interdisciplinary component anticipated many of the collaborations that would typify Kagel's future work.

In addition to his musical opportunities, Kagel's compositional development in Buenos Aires was substantially influenced by a non-musical source: his contact with prominent writer Jorge Luis Borges. Borges's influence in Kagel's work can be seen in his interest in labyrinths and encyclopedias, as well as his "preoccupations with parallel realities governed by strange rules"[273] – this characteristic is quite relevant for *Antithese* in particular. Heile also points to Borges fostering of Kagel's interest in the use of visual media,[274] which pervades Kagel's artistic output. Borges employed Kagel as photography and film editor of the journal *Nueva Visión,*[275] and also probably had influence that transcended the directly artistic. Mikawa points to Borges's liberal anarchism as being important in Kagel's philosophical formation.[276] In this analysis, Borges's anarchism, while very much a response to the Perón regime's repressive control of artistic expression, is not specifically fixated on economics or politics. Rather, it is concerned with the moral and philosophical realms, applying the idea of anarchism personally, and being a "strong individual," with Borges's anarchism predicated upon ethics and self discipline even as it rejects "an authoritarian principle which conditions people to look toward leaders for guidance."[277] The assimilation of this philosophy on the part of Kagel, combined with his his own irritation at the Argentine government's censorship of artistic works, probably informed his anti-authoritarian bent and resistance towards artistic compulsion of any kind.

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272 Heile, 14.
273 Heile, 11.
274 Heile, 11.
275 Heile, 11. Heile also points out the Kagel's interest in film and multimedia extends further back, perhaps as a result of the "decisive influence the Bauhaus had in Buenos Aires at the time" (Heile, 12).
276 Mikawa, 30.
277 Mikawa, 31-32.

Pierre Boulez visited Argentina in 1952 and met Kagel there – an encounter which would prove to be a turning point in Kagel's career. At the behest of Boulez, Kagel sought to travel to Paris to study, applying for a scholarship to study *musique concrète* at the Club d'Essai in Paris, but was not selected.[278] On Boulez's return trip to Argentina in 1954, Kagel showed him *Música para la torre,* after which Boulez suggested he try to study at the electronic studio of the WDR in Cologne – Kagel's subsequent scholarship application was approved.[279] Kagel arrived in Europe in 1957, shortly after Stockhausen's *Gesang der Jünglinge*, which integrated *concrète* and *elektronische* practices. Even so, there was still opposition between the two camps regarding ideology,[280] with the disagreement boiling down to Schaeffer and the *concrète* studio favoring manipulation of natural sounds as opposed to the serially organized, electronically generated sounds of the Cologne *elektronische* camp. From his beginnings in electroacoustic composition, Kagel seems to have viewed the differences between the two groups as being somewhat arbitrary, and has made comments that show he regarded the polemic between the partisans as foolish, saying in an interview with Renate Liesmann-Gümmer (translated by Mikawa):

> Cologne and Paris were the pioneers in the field of tape-manipulated music. Paris was a trend-setter of *musique concrète*, whereas Cologne became the puristic counterpart with its allegedly strictly logical, materialistically stringent compositional technique. It sparked a ridiculous rat-race that was stirred up not with arguments – as is often the case – but by the conceitedness of some participants.[281]

Kagel's comments seem to reflect a belief that the the main disagreements between the two camps were philosophical, exacerbated by the personalities involved (particularly, it would seem, that of Stockhausen), and that they had only minimally to do with artistic

278 Heile, 15.
279 Heile, 15.
280 Heile, 16.
281 Mauricio Kagel, "*Uber Zusammenhänge,*" quoted in Mikawa, 65.

matters. Kagel integrated *concrète* and *elektronische* sources in his electroacoustic composition from his earliest experiments in the medium, so it follows that he viewed the polemic as being somewhat artificial. This brushing off of sectarian artistic ideas would also become a pattern, in both the acoustic and electronic compositional realms.

Upon Kagel's arrival in Europe, he experimented with the serial practices that dominated European modernist ideology at the time, but seems to have chafed at the dogmatism. Though he has a number of serially influenced works, he was never wholly convinced by total serialism, and broke with Stockhausen. This break seems partially as a result of differing compositional philosophies, but also because of the reception of Kagel's work, *Anagrama* (1958). *Anagrama* premiered at the same concert as Stockhausen's *Kontakte*, at the post concert reception, *Anagrama* generated far more discussion than *Kontakte*, which Heile surmises, "the touchy Stockhausen appears to have taken personally."[282] Relations between the two men got steadily worse, with Stockhausen even trying to trying to have Kagel excluded from Darmstadt courses in 1968, writing to the director, Ernst Thomas, that Kagel "used every opportunity to badmouth him."[283]

Kagel's break with Stockhausen coincides with his interest in Cagean experimentalism.[284] He was drawn to Cage's contributions and the challenges they posed, noting in 1958 that Cage had, "contributed to the downfall of the modern serialist myth instigated by the academics of dodecaphonism."[285] Cage would prove to be an important influence for Kagel, who attended Cage's lectures on "Changes," "Indeterminacy," and "Communication," in Darmstadt in 1958.[286] The two developed a friendship, and Kagel frequently defended Cage

282 Heile, 21.
283 Stockhausen, quoted in Heile, 178.
284 Heile, 70.
285 Kagel, quoted in Heile, 17.
286 Mikawa, 175-176.

what he viewed as frequent misinterpretation and misunderstanding by European intellectuals.[287] Though Kagel was quite interested in Cage's music and philosophy, and embraced some level of indeterminacy in his composition, he never completely relinquishes control on the level Cage frequently does. In the same way that he never completely embraced serial composition, he never wholly adopted indeterminacy. It is notable that the piece Kagel realized in addition to *Antithese* at the Siemens studio was a version of Cage's *Imaginary Landscape no. 3*, and Kagel remained friendly with Cage, and interested in his music, to the point of dedicating *Antithese* to the occasion of his fiftieth birthday.

D: Indeterminacy, The Open Work, and Theatricality

Antithese's indeterminacy fits fairly well into Umberto Eco's concept of *The Open Work*.[288] Eco introduces this category of work by referring to a number instrumental pieces contemporary with *Antithese,* including Stockhausen's *Klavierstücke XI,* Boulez's *Third Sonata for Piano*, and Pousseur's *Scambi.* He describes these works as having a common feature:

> The considerable autonomy left to the individual performer in the way he chooses to play the work . . . he is not merely free to interpret the composer's instructions following his own discretion (which in fact happens in traditional music), but he must impose his judgment on the form of the piece.[289]

In Boulez's Third Sonata for Piano, for example, "The first section is made up of ten different pieces on ten corresponding sheets of music paper. These can be arranged in different sequences like a stack of filing cards, though not all permutations are permissible."[290] Eco

287 Mikawa, 180.

288 Interestingly, Mikawa spends a fair amount of time discussing the *Open Work* as it relates to Kagel's serial thought (see Mikawa, 198-206), but spends little time on what I feel is the most profitable application: the nature of *Antithese*'s indeterminacy in general.

289 Umberto Eco, *The Open Work*, trans. Anna Cancogni (Cambridge: Harvard University Press, 1962, 1989), 1.

290 Eco, 2.

describes the significance of this:

> A classical composition . . . posits an assemblage of sound units which the composer arranged in a closed, well-defined manner before presenting to the listener. [The composer] converted his idea into conventional symbols which more or less oblige the eventual performer to reproduce the format devised by the composer himself, whereas the new musical works referred to above reject the definitive, concluded message and multiply the formal possibilities of the distribution of their elements. They appeal to the initiative of the individual performer, and hence they offer themselves not as finite works which prescribe specific repetition along given structural coordinates but as "open" works, which are brought to their conclusion by the performer at the same time as he experiences them on an aesthetic plane.[291]

Eco does not mention Kagel's works in his discussion of the open work, but many of his pieces, for the time period we are concerned with and beyond, match quite well with Eco's description.[292] Kagel, however, goes even farther than ceding control to a performer, using this cession as a way to question the concept of a musical performance itself.

Heile notes that American experimentalism and the European avant-garde is often framed as being in conflict philosophically, with the "American" style using indeterminacy to relinquish authorial control as an aesthetic end, and the European style seeking to research new artistic possibilities, with renunciation of control the means to the end of a new artistic possibility. Kagel, as Heile argues, links these two conceptions (which are not irreconcilable) in his compositions[293] – these compositions often question the concept of a musical work, writing in audience or critical reactions to the piece as it is being performed. Kagel pairs *open work* techniques with a theatricality that he came to call "instrumental theater," a term used originally by Heinz-Klaus Metzger and adopted by Kagel.[294]

Throughout the period leading to *Antithese*, Kagel shows a predilection for theatrical and

291 Eco, 2-3.
292 Mikawa discusses the concept of the *open work* with regards to *Antithese* (see Mikawa, 198), but does not seek position it as a larger organizing principle of Kagel's larger output.`
293 Heile, 69.
294 Heile, 34.

multimedia compositions. Kagel's theatrical compositions tend to be rather unlike musical theater as it is popularly conceived. They draw attention to the act of performing instrumental music as an inherently theatrical activity. The motions performed would often not directly connect with the sound production of the musicians.[295] For example, in one of the movements of *Sonant* (1960), the instrumental ensemble has to feign strenuous performative activity on their instruments, while producing nearly inaudible sound.[296] This incongruity draws attention to the physicality of playing an instrument, something that is often taken for granted. Uncoupling the sound and visual component reveals the inherent theatricality of instrumental performance.

The instrumental theatricality of *Sonant* has a counterpart that comments on the inherent theatricality of a musical performance as a whole in *Sur scène* (1960), and Heile notes that they start from opposite vantage point, but are getting at similar themes.[297] *Sur scène* is scored for instrumentalists, singer, speaker, and mute actor, each of which take the role of the protagonists in a musical performance.[298] The actor portrays an audience member, who consciously tries to mirror and interact with the *actual* audience members, while the speaker plays the part of a critic, reading an opaque musicological text as the instrumentalists mock-practice disinterestedly and the singer sings, operatically, a part that relates to nothing else.[299] This type of performance raises questions about the nature of the concert-experience itself: are the musicians actually performing, or just seeming to perform? What is the distinction between an instrumental performance and a theatrical one?[300] Both of these works take the

295 Mikawa, 14.
296 Heile, 37.
297 Heile, 35.
298 Heile, 38.
299 Heile, 38-39.
300 Heile, 39.

act of musical performance themselves as their area of artistic inquiry, and this issue is also at the heart of the theatrical version of *Antithese.*

Kagel's compositional philosophy and aesthetic at the time of *Antithese* was informed by a wide range of interests an influences, melding *musique concrète* with electronic composition, serial techniques, American experimentalism, the *open work*, and instrumental theater in order to embark on meta-explorations of music performance and reception. To understand the significance of his time at the Siemens studio, and to get a better feel for how *Antithese* was both emblematic and unique among his output of the time, it well help to look at some of his work that immediately preceded it: in particular, *Transición II.*

E: Antithese *Antecedents*

Kagel started his first Cologne-based electronic piece in 1959 – a work that would eventually come to be known as *Transición I*. *Transición I* was finished in 1960, after *Transición II* (1959), so the labeling of these pieces can be potentially confusing. Mikawa focuses on *Transición I* extensively as a precursor work to *Antithese*, and with good reason: many of the aesthetic characteristics of Kagel's electronic compositions can be traced to it. Heile describes the piece as using "long sustained sounds that change in pitch, bandwidth and timbre over time: the first sound, for instance, lasts for over a minute during which it develops gradually."[301] The dramatic directions for *Antithese* allow for a fragment of *Transición I* to be played during the performance of the work, and the aesthetic is similar enough that it does not feel particularly jarring. That said, I believe that it is *Transición II* that has the clearest relationship with the final, theatrical version of *Antithese*, released in

301 Heile, 31.

1965. Though it has an instrumental component, in many cases the instruments serve a similar role as the *concrète* sounds do in *Antithese* – both works blend the electronic and acoustic, purposefully blurring the line between sound sources. Even more crucial is the importance of the instrumental theater concept in both works. A more detailed exploration of *Transición II* will help to show where *Antithese* came from, as well as how it was innovative.

Transición II is scored for one pianist, a percussionist who plays inside the piano, and two tapes, one of which can be set to record and then play back during the performance itself, lending the work a recursive quality.[302] The score consists of 21 "structures" in 35 pages. Each page indicates one of three types of structure (A, B, or C). Performers freely choose from among the structures, as long as the piece's playing time totals at least ten minutes. The arrangement of structures is free within certain guidelines,[303] which taken together, seem to have a comically complicated design: an A or C structure must begin the work, and a B or C structure must end it. C structures must be arranged so that their index numbers be presented in ascending order, while A structures can either be arranged so that their index numbers are in ascending order with B structures free, or vice-versa. There are then two exceptions to this scheme, allowing the work to be played either straight through or in retrograde. If the formal architecture was not complicated enough, the score itself is written in a highly individualized notation, sometimes in a proportional, freer style, and sometimes in an exactingly notated conventional style. Kagel gives instructions for which parts should be recorded and played back during the performance, and allows for sections to be processed to alter timbre. Each structure has accompanying instructions. Though Kagel includes sixteen pages of explanation at the beginning of the score, there are still many unanswered questions about

302 Heile, 25.
303 This work, consequently, fits well into the *Open Work* concept.

performance, particularly with regard to logistics.

In his discussion of the work, Paul Attinello classifies the musical structure as a "moment form,"[304] and notes that each section represents utilizes a different serial construction.[305] However, Kagel intentionally seems to make the architecture opaque, in that he specifies the serial detail "with highly arbitrary graphic signs, and the overlay(s) that combination with elaborate methods of chance interpretation."[306] There is, then, serial architecture in the work, but it is completely obscured by its representation.

During performance, the percussionist must often prepare the piano in real time as the pianist plays the different sections. The players will frequently get in one another's way, hindering the performance – a feature that Heile believes Kagel intentionally planned into the work.[307] The visual and aural effect of this is complex interaction between performer, instrument, and tape-apparatus is a manic theatrical struggle against an out-of-control machine.[308] Crucially, this imagery becomes even more explicit in *Antithese*, where the setting for the work is explicitly designed to resemble a laboratory. In the case of *Transición II*, the impression is more implicit, but the freneticism and the focus on the instrument as an object conveys a similar effect.

Heile describes *Transición II*'s musical material as "almost completely amorphous,"[309] and the approximate nature of most of the notated parameters means serial control over the piece is impossible. The relationship between the parts of the piece's microstructure seem

304 Paul Attinello, "Imploding the System: Kagel and the Deconstruction of Modernism," in *Postmodern Music/Postmodern Thought,* ed. Judith Lochhead and Joseph Auner (New York: Routledge, 2002), 264.
305 Attinello, 265.
306 Attinello, 265.
307 Heile, 25.
308 Heile, 25-26.
309 Heile, 28.

essentially random, with an overall impression that the work "eschews coherence, closure, and unity."[310] I would hypothesize that the formal and notational complexities of the work, while certainly lending it a unique and highly unconventional sound (processed tape being played back into a prepared piano is timbrally fascinating), primarily exist to facilitate the theatrical effects. The work, then is similar to *Sonant,* where sound and action are uncoupled, except that in *Transición II*, the uncoupling is more conceptual: the score exists not to ensure a particular sound, as we might expect, but to ensure a desired performative impression. Written musical instruction facilitates a specific visual theatrical action.

The immediate question this raises, then, is whether or not the work is an elaborate farce; Attinello, for his part, concludes that the piece represents a moment "when the earnestness of serialism becomes indistinguishable from a joke."[311] The main point of the piece (if there is a main point) seems to be turning the familiar piano into an infernal machine, then pitting two performers against it in an epic struggle, with the result being a complex, otherworldly, and structureless soundscape. In spite of this, there is good reason to believe that it is not simply a satire of a decadent avant-garde fetishization of control and the incoherence that can bring. The Byzantine complexity of the architecture is an aesthetic end in itself, and Heile posits the equal pairing of absurd and serious is traceable to South American culture. The effect is that, "the wondrous and absurd go hand in hand, just as they do in Borges's stories."[312] *Transición II* is simultaneous absurd, serious, and surreal, and to assess it solely by its internal coherence or formal arch is to miss the point entirely.

These ideas form the conceptual underpinnings for *Antithese*, where Kagel replaces the

310 Heile, 28-29.
311 Attinello, 266.
312 Heile, 30.

transformation of the familiar piano with more literal simulacrum of an out-of-control machine. This changes the site of inquiry somewhat; in works like *Sonant* and *Transición II,* Kagel is exploring the ritual and theater of concert-hall performance. At the time, performances of electroacoustic works were still a rather new phenomenon (whose trappings were, no doubt, informed by prior concert etiquette). Consequently, it is not solely the practice of performance that Kagel is exploring in *Antithese* (introducing a performative aspect into what is arguably the intrinsically least performative musical medium), but also the question of what it means to be an audience member, communally listening to recorded work of electroacoustic music.

F: Antithese – *Piece for One Performer with Electronic and Public Sounds*

Antithese represents a culmination of many of the themes running through Kagel's work in the period, combined with ideas influenced and made possible by the ideological environment and facilities of the Siemens studio. The technical capabilities seem well matched to Kagel's musical tastes at the time (this will be discussed further below), and Mikawa notes that the "distinctive features" of the studio had a palpable influence in the form, style, and music of *Antithese*,[313] especially the studio's strong multidisciplinary focus. That multidisciplinarity was a direct result of the Mode 2 aspects of the studio's creation, which was, of course, intimately tied to the creation the score for *Impuls unserer zeit.* While some, like Boulez, were wary of the studio's focus on film music,[314] Kagel's interest in cross-disciplinary projects meant the studio was a natural fit.

As previously mentioned, two finished versions of *Antithese* exist: one, the final live

313 Mikawa, 97.
314 Mikawa, 100.

theatrical version published in its final version in 1965, and the second, a film version, representing one possible realization of the theatrical version, finished later that same year. Though Kagel would make numerous changes to the work, the basic structure of the piece remained the same: as the electroacoustic work is played to the audience, an actor puts on a theatrical performance, sometimes seemingly related, sometimes seemingly unrelated, to the work, complete with props. *Antithese* seems to have been conceived from the beginning as a multimedia work, being premiered in an early staged form in Cologne in 1963, and the earliest sketches of the dramatic instructions being dated to 1963.[315] That said, Kagel explicitly allows for the composition to be played "independently of scenic performances."[316] That said, there is nothing to suggest that the theatrical instructions were not a part of the work's conception from its genesis.

Like *Transicion II*, *Antithese* presents a number of difficulties for the analyst. To start, the titular "Antithesis" of the work is somewhat ambiguous. Mikawa notes that Kagel gave varying accounts of the piece at various times: in a letter to Cage (to whom the work is dedicated) in 1962, Kagel wrote that "the piece has no 'anti' and no 'these' which characterizes the music to wide-awake antithesis."[317] This conflicts somewhat with statements given at a lecture at SUNY Buffalo in 1965, where he made statements to the effect that all musical composition is a dialectical process, and that "by the opposition of fundamental statements or behavior, you can arrive at very intense results, which are not only ideological but also musical."[318] It is easy to imagine the letter to Cage playfully expressing a Zen-koan-like snippet that initially seems nonsensical or contradictory, but nonetheless

315 Mikawa, 159.
316 Kagel, 21.
317 Kagel to John Cage, 23 December 1962, quoted in Mikawa, 4.
318 Kagel, "About the musical theater," lecture, SUNY Buffalo, 3 April, 1965, quoted in Mikawa, 4.

expresses a deeper truth about the work. Kagel's conflicting, often nebulous categorization of the nature of antithesis as it applies to *Antithese* seems to stymie more apparent readings, like that of Heile, who suggests that the primary antithesis is the use of *concrète* sounds versus electronic sounds[319] (also, the fact that the work contains *concrète* sounds that have been electronically processed would seem to complicate this reading). Rather than conclude that the "antithesis" of *Antithese* refers to any one parameter, I believe that "antithesis" speaks to several deeper tensions at play in the work. This includes the conflict between performance and a non-performative medium, as well as several layers of juxtaposition of continuity and discontinuity in both the sound-design and the dramatic action.

As with many of Kagel's other works, trying to assess *Antithese*'s organization presents a number of challenges. Rather than understanding the work through more conventional musical features, either through a serial structure or motivic or formal development, the aforementioned dichotomy of connection and disconnection helps to give the work a larger structure. This combines with layers of ambiguous narrative to create a dynamic interplay that seems to pervade *Antithese* at every level, including the theatrical directions, the relationship between the theatrical action and the sounds of the piece, and the sound world of the piece itself. The film version of the work further explores and expands this interplay, and I believe can be viewed as a larger commentary on the relationship between avant-garde composition and its surrounding cultural context in general, and electroacoustic music and its audience in particular.

The final published version of the work, released in 1965, consists of two parts: the tape music, and a score laying out the parameters for the actor's performance. The tape music is

319 Heile, 44.

structured as a piece within a piece, with the bulk of the work embedded between preconcert crowd-noise and post-concert mingling, and audience reaction to the work as it progresses. The score enumerates 23 "main actions," consisting of single-word descriptions to be acted out by the actor. These include words like "clean," "surprised," "furious," or "noisy." Each action has a number of different possible sub-actions supplying options for how it could be realized: for example, sub-actions for the main action "clean" include, "dust somewhat hysterically with a large duster," or "kick everything lying on the floor into a heap." The props with which the performer interacts, as Kagel writes:

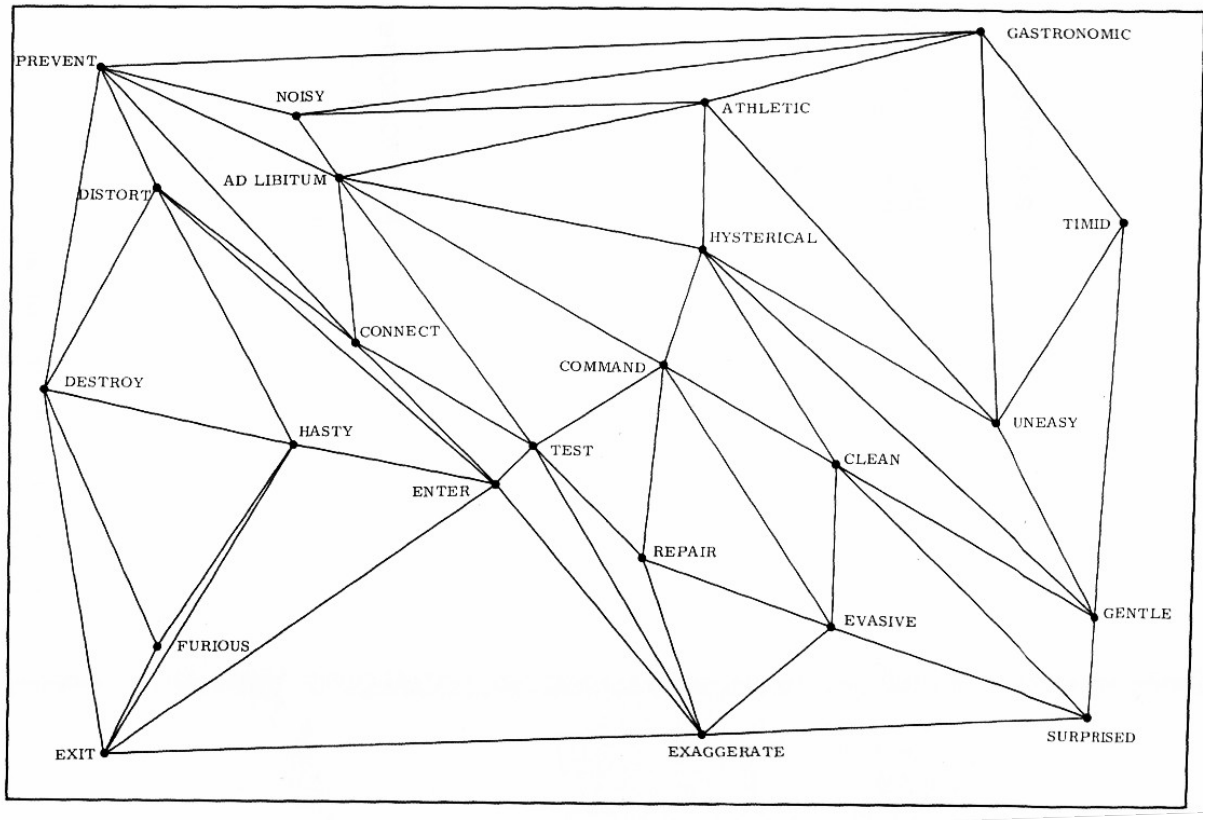
> Characterize a neglected, dusty laboratory, and at the same time give the impression of a retrospective exhibition of the apparatus which has been used for relaying sound from the beginning of the century up to the present day: old record players, horn gramophones, old-fashioned tape recorders, loudspeakers of all sizes, radio shells and dismantled chassis . . . On the ground loose tapes, tools, a jumble of cables, tape-spools technical blueprints, and many more.[320]

Rather than freely choosing or aleatorically deciding which actions to perform and when, Kagel instructs the performer to predetermine the path through the main actions by means of a pre-constructed web (see fig. 3.1). The performer can determine the precise timing of each action in one of three ways: he or she can use the music as a starting point, listening to the work several times, coming up with a plan of travel through the web, selecting sub actions, and fixing their durations; alternatively, the main actions can be selected, the lengths of the lines between the actions measured and summed (in centimeters), and each action given time proportional to the line lengths in the context of the total length of the work (9'27"); or finally, the performer could begin with the array of scenery available, choosing actions that specifically match the props, while still holding to the web of paths through the actions. Either the first or third option can be combined with the second, giving a great deal of

320 Mauricio Kagel, *Antithese* (New York: C.F. Peters, 1965), 19.

flexibility to performance, while still supplying a measure of structure, very much in the manner of Eco's *Open Work*.

Figure 3.1 – Chart of Main Actions, English



There is a semblance of a serial organization possible in the performance of the work's actions, in that a performer could hypothetically use the lengths of the lines of the drawing to create a unity between lengths of durations in the music and time taken for dramatic actions. However, a genuine serial structure is all but precluded by the number of versions of the web; The score includes instructions and actions in German, English, and French, and while the instructions are the same, the webs are all wholly different – different actions are attached to one another, the lengths between actions vary, and there are different total numbers of connections between actions (the French and German version have 55 possible connections,

while the English has 58). This, then, seems similar to *Transicion II*, in that the score reflects an apparent pre-compositional scheme that would suggest a serial architecture, but in reality has only the outward appearance of serial complexity, without a genuine serial organization in mind. Here, as in *Transicion II*, the point seems to be to make the performer engage in a circuitous pre-construction of the work, with that convolution and the accompanying struggle acting as a goal in itself.

As with *Transicion II,* the effect of the theatrical action is that of a performer as mad-scientist, grappling with a machine. Unlike *Transicion II*, that machine is a representation of actual laboratory equipment, so these implications have now become explicit, as the performer entangles themselves with all manner of arcane-looking equipment. The theatrical instructions play up this imagery, with many of the actions focused on erratic interactions with the machine (for instance, "pull long cables and tapes out of machines, wind them round a chair . . . and knot them round table-legs and apparatus").[321] A key difference between this type of action and that of *Transicion II* is that in the case of *Antithese*, the action is actually completely untethered from the sound. In his prior work, the performers' labors had a direct effect on the sound produced for the performance. In *Antithese*, this is, of course, impossible, as the performers have no impact on the tape music. Furthermore, he gives explicit instructions that the action should not be a pantomime depiction of the tape. The nature of the interaction between sound and action is complicated, and reflects one of the chief tensions in the work.

The theatrical aspect of *Antithese* was the product of Kagel's work with Alfred Feussner, a long-time collaborator. Mikawa credits Feussner with being a profound influence on the

321 Kagel, 16.

stage and film versions of *Antithese*, as well as on Kagel's conception of Instrumental Theater in general[322] – Kagel and Feussner wrote the script of the film version of *Antithese* together, and Feussner had appeared in and collaborated on Kagel's earlier works of instrumental theater, performing the speaker's role in *Sur Scène*.[323] Feussner was the actor in the Cologne premier, and Mikawa theorizes that the published version of *Antithese* reflects Feussner's interpretive suggestions.[324] This includes a note to the effect that the actor should not attempt to choose gestures and actions that mime the music. As Mikawa puts it, the action part does not really "accompany" the music, instead providing a jumping-off point for the actor to construct a complementary form for performance.[325] Mikawa postulates that Kagel noticed the tension between representation and non-representation of sound in Feussner's performance, which helped to concretize the need for a degree of indeterminacy, thereby completely divorcing the dramatic action from the sounds of the piece.[326]

While Feussner's influence is worth noting, Kagel had been moving aesthetically in this direction in a number of ways. His previous use of Open Work-type models would certainly lend support to the idea that he wanted the actor involved to be an equal partner in the piece's creative realization. Kagel's desire for the work to be truly interdisciplinary, rather than simply having a theatrical veneer slapped onto it, speaks to his continuing desire to add new elements to avant-garde composition. Even so, the work is a peculiar manifestation of collaboration – the two sides of the complete work seem outwardly to have little to do with one another.[327] The disconnection between the visual and auditory gives an impression that

322 Mikawa, 158.
323 Mikawa, 158.
324 Mikawa, 159.
325 Mikawa, 160.
326 Mikawa, 160.
327 From the vantage point of this paper, this in itself almost seems to parody the Mode 2 model.

this is two works superimposed on one another. As Mikawa intimates, Kagel gives explicit instructions regarding this in a footnote, appearing in the section describing constructing the actions:

> Because of the permutable, preformed actions, it will be clear that the actor cannot give an interpretation of the musical processes, as, with the variable forming of the scenic order, the independence from music is determined beforehand. In any case, a "faithfully adapted" transference into adequate movement sequences would be out of place. The exclusive task of the performer remains, therefore, to find the superior reasons – analytical, psychological, frivolous, psychosomatic, senseless, peripatetic, tone-psychological, etc., etc. –, which justify his acting to himself.[328]

Regardless, there are points where the actions carried out by the performer necessarily interact with and even affect the sound of the music. For instance, in the "Command" subsection, the performer has the option to "cause several loudspeakers standing some distance away to stop by means of hand-given signals."[329] Alternatively, an option for "distort" is that the performer can "turn various knobs. At the same time, the technician in the control room performs distortions of the sound and feedback."[330] Heile writes that the result of the visual and aural action is that, "one can never be quite certain whether the music is a product of the stage action or accompanies it."[331] One might go even further than this assessment. Given Kagel's instructions not to directly interpret the music dramatically, combined with specific actions that *necessitate* interaction between action and sound, it is reasonable to conclude that Kagel is seeking to create for the audience an ambiguous relationship between action and sound, at times corresponding, and at times seeming to have little to do with one another.

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328 Kagel, 23.
329 Kagel, 16.
330 Kagel, 16.
331 Heile, 46.

This might strike the observer that the end result is the theatrical action appearing arbitrarily combined with the music. Kagel's explanatory notes make it clear this is intentional, writing that, "it is the audience's business to find connections between actions and sounds."[332] He anticipates a possible criticism of this scheme in another footnote, justifying it curiously:

> One might protest that the music of *Antithese* becomes a background of sounds and noises here, if one were not aware of the equally unequivocal background character of the given actions, whose untendentious, time-wasting nature is an authentic counterpart to this form of construction of the staging, taken independently of the music.[333]

This is a rather remarkable justification: If the music seems like an unnecessary waste of time, we should take heart in the fact that the actions are equally directionless. Rather than frame the music and action as both crucial to the work as a whole, Kagel frames them as equally ancillary, with nothing taking center stage. This may itself be a wry commentary on the nature of the interaction between the world of avant-garde composition and its supposed audience; spectators are confronted with a performance they cannot hope to understand. This explains the perplexed reception many works in this style received. Kagel makes this explicit by putting on a work of background noise and action – in essence, an anti-drama (another possible reading of the core "antithesis" at the heart of *Antithese.*)

G: Connection and Disconnection in the Music of Antithese

The tension between action and sound forms one of the clearest and most persistent examples of the interplay of connection and disconnection present in *Antithese*, but the music itself has analogous aspects, even if divorced from the theatrical action. To understand this,

332 Kagel, 21.
333 Kagel, 23.

we must first understand the most readily apparent impression of the role of electronic and *concrète* source material in the work. Kagel's sketches are useful in trying to parse this. Mikawa reproduces Kagel's rough formal sketchs of the work, noting that Kagel lists five sections in the work, sectionalized based on the content and organization of electronic sounds.[334] Mikawa gives approximate durations, for these sections, reproduced below (fig. 3.2)[335]. It includes notes about the *concrète* sounds used in each section.

Figure 3.2 – Kagel's Notes on Sectionalization, after Mikawa[336]

> First section (or introduction): duration 1'50": atmosphere and applause
> Second section: duration 1'05" (to 2'55"): yell, whistle, and applause
> Third section: duration 0'49" (to 3'44"): whistle
> Fourth section: duration 1'26": (to 5'10"): applause, atmosphere, and cough.
> Fifth section: duration 4'17": (to 9'27"): nose-blowing, yell, applause, whistle, muffled talk

Both Heile and Mikawa note that the piece's formal boundaries can be defined by the placement of unaltered, *concrète* sounds,[337] and, at least as far as the crowd noise that bookends the bulk of the piece, this is quite correct. The crowd noise is, as Heile describes, "a fictional account of its own performance within itself."[338] Initially, it sounds like a restless crowd talking and rustling before a performance. Later, the crowd returns, this time booing in disapproval. Later still, the crowd returns again, at times applauding, at times whistling. Finally, as the piece ends, the crowd mumbles and chats, as if milling around after the concert, or discussing the performance at a cocktail reception.[339] This crowd reaction to a recorded piece has precedent in Cage's *Williams Mix*, though in the Cage piece, there is less

334 Mikawa, 114.

335 Mikawa, 115.
336 Mikawa, 115.
337 See Mikawa, 109, and Heile, 44-45.
338 Heile, 45.
339 Heile, 45.

of an implied narrative (which in *Antithese*, feels very much structured by the audience reactions).

Mikawa asserts that "all concrete 'raw' materials of *Antithese* are immediately distinguishable from sine-wave-based sounds,"[340] and though not stated as explicitly, Heile seems to hold a similar idea. However, this formulation creates the impression of a starker dichotomy at work in the sound material than actually exists. This assertion is surprising, given that both writers make the point that Kagel intentionally blurs the line between electronic and *concrete* sound.[341] In reality, Kagel often employs electronically altered *concrète* sound, often layering processed materials with electronically generated material, to create a gradient between performance and audience reaction. Understanding these moments helps to create a fuller picture of what Kagel is doing.

The opening soft-chatter of the audience before a concert, which has a broad-spectrum white noise component, is gradually layered with electronically-generated white noise that, in time, almost (though not entirely) supersedes the *concrète* noise of the crowd. This creates a gradual transition that is less two distinct, contrasting sound-worlds, and more of a spectrum. This blurring is, in effect, confirmed by the next clear sound event (at 0'51"): a yell modified by vocoder (or possibly pitch shifter) to create a jarring and obvious hybrid sound effect. This adds another dimension to the interplay between electronic and *concrète* sounds, and continues in sections two and three. In section two, the crowd reasserts itself, booing and whistling in disapproval to the action of the electronic score. In time, these whistles become part of the fabric of the music – they are processed and combined with electronically-generated whistles to form much of the material in section three. Because of the interplay

340 Mikawa, 109.
341 See, for example, Mikawa, 109.

between electronic and *concrète* source sounds, I do not believe it is fruitful to define the form of the work through framing their use as a structural opposition, though using the sketch of source *concrète* sounds to get an overall feel for the musical form of the work can still be useful.

Returning to Mikawa's duration analysis (fig. 3.2), his readings for the first two sections are, I believe, quite correct. These sections are set apart by silence, and their sound material is quite different from what precedes and follows. The exact junctions between sections three and four, as well as between four and five, are ambiguous, and I believe that the remaining sections are, in essence, ellided with one another. Ultimately, I do not believe that the precise borders of these sections are particularly important to how we perceive the piece – the fluid nature of how this material unfolds gives the abiding impression of formal continuity, rather than the clear sectionalization of the first two units. The question is raised, then: how are we to understand how *Antithese* is structured?

I believe that there are two primary ways that we might approach this: first, to comprehend the interplay between *concrète* and electronic sounds, it is useful to view the piece as an ambiguously directed quasi-narrative structure involving an audience reaction to the performance of an electroacoustic work. This can be reinforced by the main actions, and is further clarified in the film version of the work, which will be discussed at length later; second, in appraising the arrangement and interaction of the varying character of sound materials employed, we can best understand the sound world of *Antithese* through observing the juxtaposition of connected material and disconnected material. Below is a chart of some of the most salient examples of these continuities and discontinuities (fig. 3.3), spanning both dramatic and musical aspects.

Figure 3.3 – Table of Continuities/Discontinuities

Dimension	Continuity	Discontinuity
Electronic/concrète material	Integrated	Juxtaposed
Sound character	Linear glissando-material	Ambient or impulse-based material
Form	Continuous	Segmented
Theatrical Action	Reflects sound	Independent of sound
Visual cause/effect (in film)	Representative	Offset

Both Heile and Mikawa comment on Kagel's predilection for long, connected lines in his electronic music. Heile compares the long curving sounds of *Transicion I* with *Antithese*, noting that like the former, the latter employs, "sustained sounds, often glissandoing slowly in meandering shapes."[342] Mikawa similarly recognizes this tendency in *Transicion I*, and explores it in relation to Xenakis's *Metastaseis* and *Diamorphoses,* as well as Ligeti's *Atmosphères* and *Glissandi*.[343] Mikawa believes that these pieces share with *Transicion I,* and to a lesser extent, with *Antithese,* a similar scheme of musical continuity.

While the glissando-sound itself can represent a certain literal reading of continuity in that it is a non-discrete pitch space, for the purposes of *Anithese*, Mikawa is more concerned with the continuity established by the seamless transition between electronically generated and *concrète* sounds. While this is a salient aspect of the piece, but I believe spectrographic analysis of the work shows the clear structural importance of the juxtaposition, development, and synthesis of continuous and discontinuous sounds, exemplified by glissando material, and broad-spectrum ambient or impulse-based material. The glissando material Kagel employs gives the work a wormy, uncentered quality because they never settle on a single

342 Heile, 46.
343 Mikawa, 74.

frequency, instead meandering without a clear destination. This gives an unsettled, off-balance feel to many of these sections. The ambient and impulse material, by contrast, tends to lend a more static, settled feel, (even though the sound itself is comprised of many disconnected attacks), since the impulses, taken together, blend to form a single fabric. The juxtaposition and synthesis of these sound qualities give the work it's characteristic sound.

I posit a structure that can, as per Kagel's sketches, and Mikawa's description, be broken into five sections – the first two stand alone neatly, and are bookended by silence. Sections three and four have a fluid boundary, but the silence after section four provides a fairly clear boundary. I believe that their definition is based on the differing qualities of their musical material. Finally, section five, which takes up nearly the whole last half of the work, is very continuous in it's character, and cannot be easily broken into subsections.

Kagel clearly exhibits the impulse/glissando juxtaposition in the first section of the work, up until the first pause just before the 2'00" mark. The first half of the section exhibits the ambient sound material (in the form of crowd noise, then white noise), while the last half exhibits the continuous glissando material, in the form of processed vocal yells. At 0'32", the *concrète* applause is superseded by electronically generated noise, creating a continuity of ambient noise, superimposed over the mumbling crowd that has been present since the opening of the work. At 0'51", there is a sudden, downward directed, electronically-processed vocal yell – the first glissando-type material utilized in the piece. Low-level crowd noise dominates until 1'08" when heavily processed vocal noise picks up again in earnest, panning from left to right as it dissolves into pitched ambient noise that blurs the line between continuous glissando sound and discontinuous impulse material, which pans back from right to left (see fig. 3.4 for an annotated spectrogram.) Within this first section of the work, the

primary dichotomy pairings that drive this work's structure are presented and synthesized. This section reflects the clearly segmented formal nature of the beginning of the work, ending with three full seconds of silence.

The second section presents a further exploration of the impulse/glissando dichotomy, employing a primarily impulse-based texture, but structured in the continuous shape of a glissando. As with the first section, the stretch of the work is set apart with silence on either side of it. This section has a clear narrative quality to it, which will be explored later, but from a perspective of the sonorities employed, the effect is a dramatic ramping up of density of sound and attacks with a series of upward frequency trajectories (see. Fig. 3.5). As with the first section, this segment is set apart by silence.

Figure 3.4 – Annotated Spectrogram Section 1 of *Antithese*

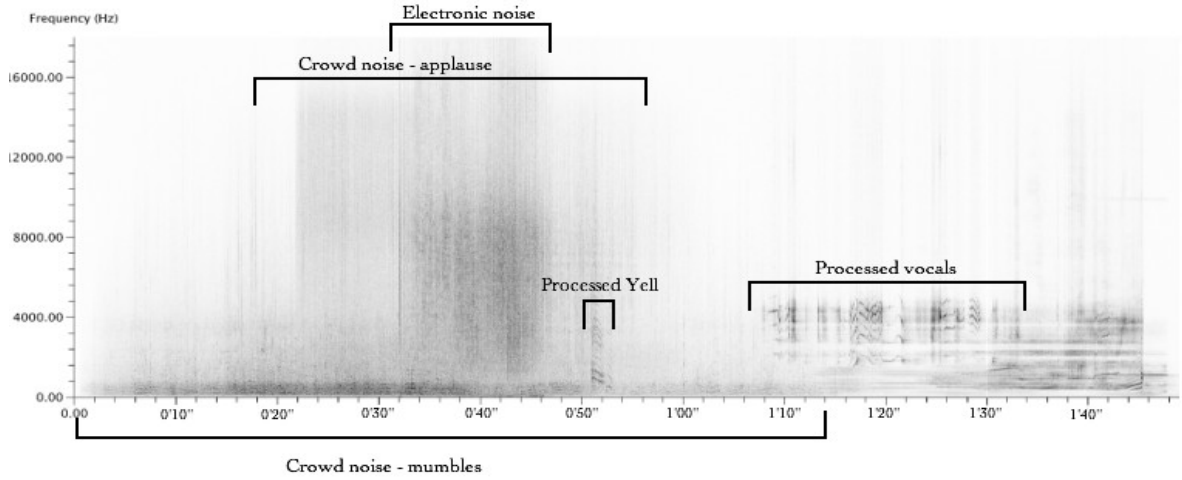
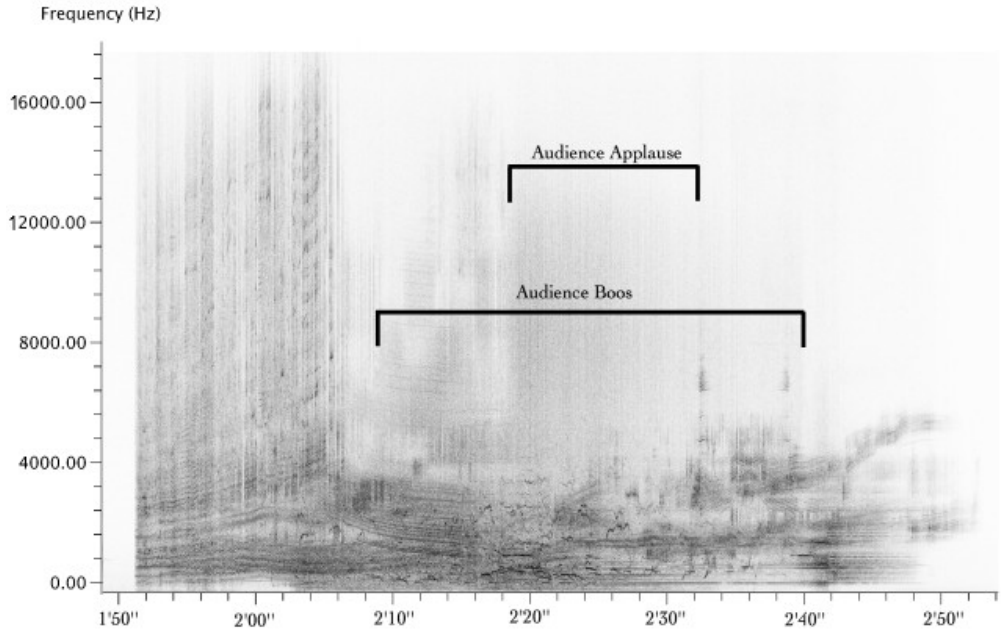


Fig. 3.5 – *Antithese* Section 2



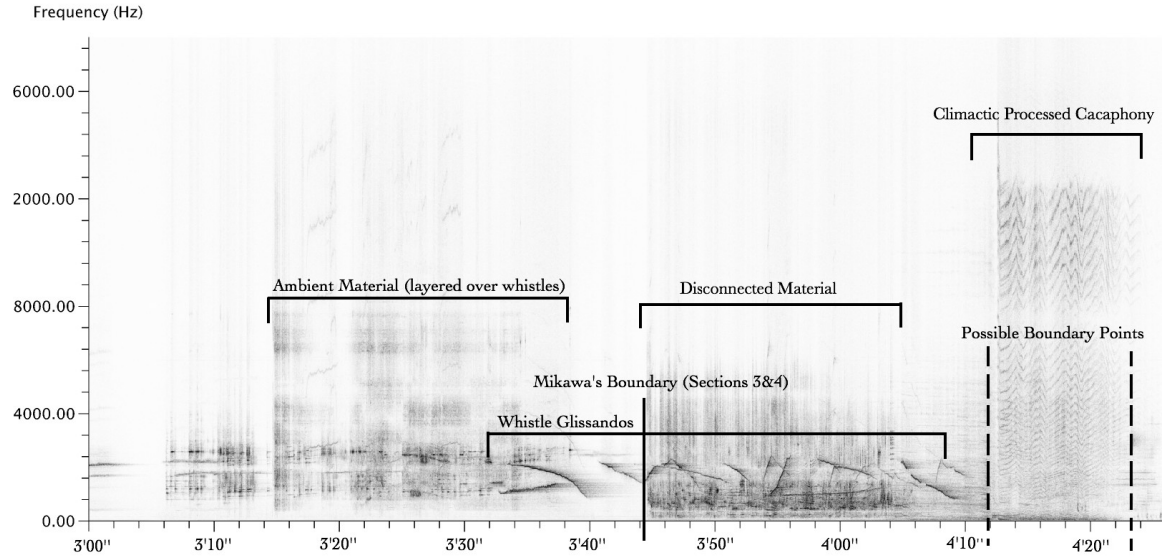
The majority of material in this second section is electronically generated, and gives the aural impression of a machine being turned on and becoming more and more active. From the perspective of impulse-material versus glissando-material, this section represents a clear synthesis, individual attacks that nonetheless describe curving, linear fragments. The relationship between electronic and *concrète* source sounds is different in this section than the first. In the first section, electronic sounds were melded seamlessly with the crowd noise to create a unified electronic/*concrète* ambience. In this section, the crowd noise is introduced as a clear reaction against the increasing intensity of the electronic activity, first introducing boos, then layering applause on top of that. Rather than acting as part of the piece, the audience is now directly commenting on the work. Though the sonorities begin to blend together somewhat, they are much more distinct than in the first section, and there are no clear examples of *concrète* sounds being processed electronically. The audience is placed

apart from the music, reacting to it, and there is no synthesis between the electronic and the *concrète*. At the same time, there is a clear synthesis between the disconnected impulse and the connected glissando materials, with curved linear shapes, composed of discrete attacks, audible throughout.

After the second section, the borders between different sections become more blurred, and the piece's form feels far more continuous than the clearly segmentable material that comes before. The relationship between the audience's *concrète* sounds and the electronic sounds is similarly ambiguous, without clear instances of audience-noise as commentary, as seen in the second section. The third section focuses on development of whistle-material in a slow buildup of intensity. The first thirty seconds of this section are sparse and airy, contrasting markedly with the material in section two.

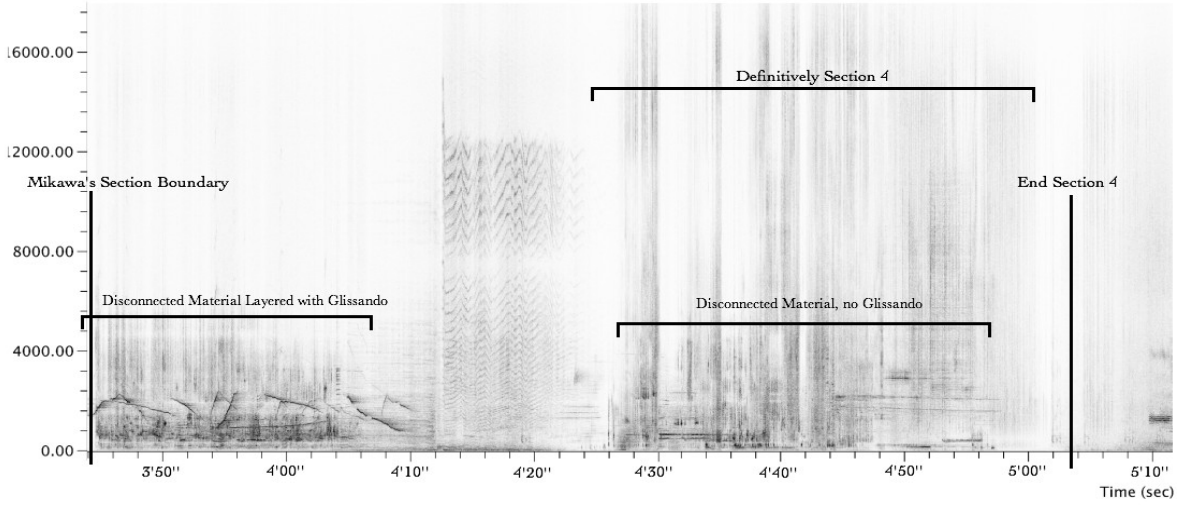
We first hear whistles introduced as part of the audience's booing and growing discontent. In section three, Kagel develops electronically-generated whistles, creating a sparse, airy texture that seems to culminate in two more directed glissandoing whistles, beginning at 3'33". This layered whistle and impulse-based material continues until a sudden, cacophonous wall of sound asserts itself (processed with vocoder or pitch-shifter). We could place the end of this section either before or after this sonority, but again, from here on out the piece does not have clear section boundaries, so it may be beside the point to quibble (see fig. 3.6. for a spectrogram of this section). This in itself could be thought of as reflecting another connection/disconnection juxtaposition, with the first few sections of the piece being obviously segmentable, and the last half appearing much more continuous.

Figure 3.6 – *Antithese,* Section 3



Regardless of where we place the beginning of section four, the material becomes distinct enough from the opening of section that it makes sense to classify it as formally distinct. Section four focuses on the impulse-based material introduced at 4'44", and, after the wall of sound at 4'12", does not employ any glissando material. The provenance of the sound material in this section is unclear, but it has been heavily processed. Gradually, *concrète* audience sounds reassert themselves, not as part of the texture of the piece, but, as with the opening section, as a commentary upon it, with the scattered applause and uneasy mumbling of an audience that seems unsettled (see Fig. 3.7). The character of this noise has a shuffling, unfocused sound about it, and is reminiscent of the audience noise at the start of an intermission. This impression is reinforced by the placement of this break, roughly 5/9 of the way through the work, and reinforces the impression that the entire work is a caricature of an electronic music concert.

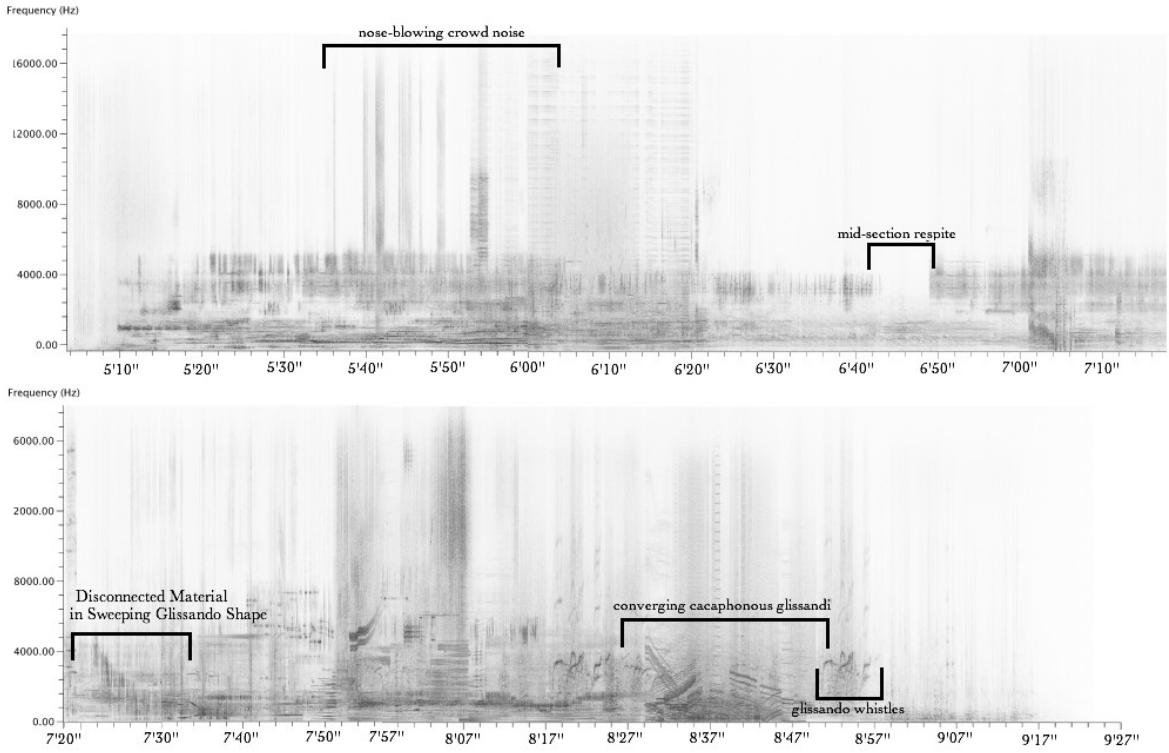
Figure 3.7 – *Antithese* Section 4



Section five is the longest part of the piece, taking up roughly half, proportionally. Within the section, seemingly innocuous aspects of the sound world are emphasized and expanded upon, often with a comic effect. The most salient sound of the section is often ambient in character, processed with the pitch-shifter to create sounds reminiscent of ring-modulation, and in the impulse-based style. Within that setting, Kagel layers interspersed noise, which comes from a variety of sources, both electronic and *concrète* (in the form of scattered claps and bits of crowd noise). Among the mixed noises a single sound source begins to dominate at 5'36": the sound of nose-blowing. This begins subtly enough, but quickly devolves into a chorus of the congested – anyone who has ever sat through a performance getting progressively more irritated by the small noises of surrounding concert-goers will appreciate the implications of a piece getting invaded and drowned-out by nose-blowing. Here, though, the noise emerges so smoothly out of the music's texture, the effect is Kagel again blurring between the piece and the concert-within-the-piece; the audience's noises are integral to the

sound of the piece itself. (See fig. 3.8 for a complete annotated spectrograph of this section).

Figure 3.8 – *Antithese* Section 5



In this final section, the synthesis between glissando material and impulse material is at its most pronounced. *Concrète* and electronic whistles continue as part of this glissando material, but heavily processed impulse material, arranged in glissandoing shapes, becomes increasingly conspicuous – larger scale curved shapes consisting of rapid, discrete attacks begin to take shape. Midway through the final section, the piece becomes less dense, with something of a break at 6'42". In the last two minutes, the piece becomes more cacophonous, with dense but discrete segments of sound. Converging glissandi merge together into a single mass of sound, that use all the processing techniques Kagel had employed to this point: the vocoder, pitch-shifter, and a layered *concrète* whistles. The piece fades out, and the audience vigorously whistles in response. The final murmurs of the post-concert crowd, followed by

an after-party, complete with clinking glasses and conversation

H: Narrative and Antithese*'s Film Realization*

The dual nature of the audience's role in *Antithese,* as both commentator on and participant in the piece, raises questions about what the dramatic portion of the work represents. Is it simply a concert of electronic music? Perhaps. But the entire scheme of props and actions complicates this formation. If the actions are directly representative of an infernal machine operated by a mad scientist (akin to the implied actions of the performers given by *Transicion II*) then it could be that the music implies a sort of diegesis – certainly not a precise, exacting diegesis, as Kagel's instructions clearly imply an end product where the relationship between music and action is ambiguous, but rather a narrative embedded in the music that comes in and out of focus in the manner of the actions' relationship to the music. Given the previous use of "infernal machine" imagery in previous works, and that there is an actor on stage, fiddling with equipment as this is happening, makes it seem narratively significant. Of course, the instructions to the actor make clear that the action on stage may or may not coincide with the tape part, and the disconnect between the narrative of the drama and the narrative of the piece seems a manifestation of the play between connection and disconnection in the work as a whole.

The film version of this work gives a unique opportunity to see how Kagel might have envisioned the nature of this narrative connection and disconnection. The actions carried out on screen by the actor do, in general, correspond to options given to the actor in the dramatic production; it is rare to see him do something not accounted for within the web of possible dramatic actions. However, they are often carried out in a way independent from the methods

Kagel lays out in the dramatic instructions.[344] This suggests perhaps that the methodology does not have a deep structural significance, but is rather a way of generating action in order to ensure a degree of disconnection between the action and tape. If the actor was allowed to freely choose the actions, it might run the risk of devolving into Mickey-Mousing, which Kagel seems keen to avoid. We are still left with the question of how the action on screen corresponds to the tape. The overall impression, I believe, is that Kagel expands the ambiguities and discontinuities present in the theatrical piece to a visual and auditory realm only possible with film. If this is the case, the ambiguities must themselves be structural. Kagel introduces a level of disconnection between action-induced cause and audio effect that is impossible with a live performance, which lends the entire film a feeling of quasi reality. It is a logical extension of the interplay between continuity and discontinuity that typifies the theatrical version.

The film, completed in 1965, is 18'00" long, so there is a good deal of sound material not found in the theatrical version. In fact, material from the theatrical version does not even begin until five minutes in. I have accounted for all sound and dramatic material in the below table (Figure 3.9), where I have listed all dramatic actions categorizable as “main actions” from the theatrical directions, as well as the source of the musical material. The main actions appear chosen to complement each other – while actions the actor performs are sometimes drawn from different main actions, they are often thematically linked (for instance, the actor might use varying actions drawn from *EVASIVE* and *CLEAN*, but overall effect is that the actor is tidying up). Together, these actions both coalesce to form a vague narrative and introduce yet another level of connection and disconnection, explorable only in film.

344 For example, skipping to a location unconnected on the web of actions.

Figure 3.9 – Dramatic and Musical Material in the Film Version of *Antithese*

Time	Dramatic Action	Sound Material
0' – 1'15"	Actor draws chart of dramatic actions (from the English theatrical instructions, but translated into German), tracing lines until the words and pathways are hopelessly obscured.	Diegetic chalkboard sounds. Soundtrack is occasionally subtly out of sync.
1'15" – 2'53"	*TEST* – Actor turns on television, which immediately displays the actor, currently carrying out his actions. Actor turns on other machines. *PREVENT* – Actor hides television with cloth. *DISTORT* – Actor muffles other machines' sounds by placing clothes into open gramophone horns.	Electronically generated impulses, seemingly meant to be diegetic and reflective of turning on machinery. However, the sounds are not entirely synced with the action.
2'53" – 5'20"	*CONNECT* – Actor connects hoses under the conglomeration of machinery. The panning camera creates confusion about where in space the actor actually is.	Water sounds, seemingly synced to the action of connecting hoses. Water intensifies as the hoses are successfully connected.
5'20" – 6'58"	*EVASIVE* – Actor moves on hands and knees, clearing tape and cables out of the way. *CLEAN* – Actor polishes small machines. *TEST* – Actor listens to various loudspeakers.	Material from the first 90 seconds of *Antithese*'s theatrical version, played unaltered (crowd noise, etc). The filming suggests that the noise becomes diegetic, coming out of the gramophone horns.
6'58" – 7'20"	We see a projection of a forest path. Suddenly, the actor is presented against the back-projected tableau, making it seem as if he is suddenly within the film within the film. *EXIT* – The actor pulls a wheeled table of apparatuses as he walks through the woods.	Musical material from the theatrical version transitions seamlessly to mixture of electronically generated “bird-song” sounds, mimicking diegetic sounds of the actor's walk through nature.

8'38" – 9'40"	*FURIOUS* – The actor tears several cables out of various machines. *SURPRISED* – The actor plays a recording of *Transición I.* *EXIT* – Listening to it on a handheld radio. The shot fades to a back-projected tableau of traffic at night. *CLEAN* – The actor blows dust from the radio.	There is a loose tie between the sound and the action of the actor disconnecting cables, but the sound is that of shattering glass and breaking machines, before the diagetic material drops out all together. A tape of *Transición I* begins.
9'40" – 11'10"	*DISTORT* – The actor varies the playback speed of various devices. The actor appears in negative, in front of a back projected traffic tableau, appearing to be suspended high above the city streets, perhaps on a window-washing stand. *UNEASY* – The actor puts on and takes of headphones, rapidly. The actor then begins hurling equipment from his perch.	The varied speed of the playback devices is reflected in the diegetic sound. *Transición I* fades out. Sounds of traffic are superimposed over the electronic sound as we see the traffic projection.
11'10" – 12'20"	The actor climbs down from his perch, and objects continue to fall on him. *EVASIVE* – Actor crawls on his hands and knees as objects rain down on him. A water scene is back projected, and the actor mimes swimming.	Material from 1'50" of the dramatic version is presented. This is the "machine-booting-up" section in the original theatrical version, and the effect in film is that an invisible audience is booing the actor as he avoids being pelted with objects that he himself threw.

12'20" – 15'45"	CLEAN – The actor polishes machinery. *GASTRONOMIC* – The actor takes a sandwich out and eats it *GENTLE* – The actor gently places a small television on the ground and watches it *CONNECT* – The actor pulls cables and tape out from under equipment, and wraps them, cocoon-like, around himself. *EXIT* – He takes off his coat as he winds more and more of the material around himself.	Sound material from the theatrical version continues. Chewing sounds are superimposed on top, as he eats the sandwich, but they are out of sync. There is material here that sounds quite similar to the theatrical version, but is not a part of the 1962 version.
15'45" – 17'20"	The laboratory, seemingly in an earthquake, begins to collapse. The actor, completely cocooned in tape and cable, is revealed to be floating on the water that was previously back projected. This is short lived, as the water is revealed to be a projection, and the actor frees himself. *GASTRONOMIC* – The actor resumes eating his sandwich. *COMMAND* – The actor gives noticeable commands to alter the lighting, darkening the set. The projected water scene is turned upside down.	Music from the theatrical version continues
17'20" - 18'00"	The actor now appears in the projected ocean-scene, re-entangled in a mass of tape, and floating. The actor is watching himself while standing on the darkened set. He conducts the sounds while the picture fades to black. Credits.	The theatrical composition ends, with gull-calls and wave-sounds played over the credits.

The majority of the action within the film can be directly traced to the theatrical instructions. The setting of the piece, that of a dusty laboratory, crowded with equipment, is similarly maintained. However, some of the more important aspects of the theatrical work are undermined, by both the increased length of the piece, and by the medium of film. Because the length of the film is roughly twice that of the original tape piece, the overall impression of the role of the imaginary crowd is somewhat different. This is in large part because there is no clear focus on the crowd noise in the film; it is the first thing we hear in the theatrical piece, but in the film, the first time we hear crowd noise is five minutes in, so it is not established from the opening that we are witnessing a piece that contains a fictionalized account of its own performance (at least not in the same way; rather than framing the sound experience, it is ongoing material within the film). Consequently, the idea of crowd feedback within the performance itself is greatly attenuated – it simply is not present enough to be a consistent force in the work. The change in the meaning of the crowd noise is also due to the nature of the actor's performance. The theatrical work is notable because it takes a generally unperformative type of music (tape music) and projects, on top of it, an ever-changing performance, with an ever-changing relationship to the music on the tape, and consequently, and ambiguous relationship to the recorded crowd sounds. By committing an actor's performance to film, the performative aspect of the work is entirely undone.

If some of the larger aspects that the theatrical version of *Antithese* explores are changed or missing, its worth noting that Kagel introduces and explores many peripherally related issues, which themselves might help to clarify the role of narrative in the theatrical version. In his discussion of the film, Heile writes that the film explores the relationship between

action and diegetic noise, focusing on synchronicity and asynchronicity.[345] He remarks on the actor's pistol produced a delayed blast of machine-gun fire, and the desynchronized diegetic "foley"-type sounds. Obviously, this type of trick is impossible, or at least much more difficult, in a theatrical setting, but I believe it has a similar effect to the disconnection created by the ambiguity of cause and effect between the theatrical actions and the sounds of the tape; there is a tie between them, but the asynchronicity creates a feeling of unreality.

If the converging and diverging relationship between sound and action in the theatrical version has an analog in the asynchronicity of sound and action in the film, then the analog to the crowd-within-a-performance reactions (and the unclear nature of the crowd's true relationship to the work) might be the frequent and jarring displacement of the actor between laboratory and television settings. From near the beginning of the film, we frequently see the actor projected into the televisions and screens he himself is watching. Heile writes that this is has the effect of underscoring the non-narrative character of the film,[346] but it also serves to take the place of the crowd noise that structures the original tape version. In the film's case, it is unclear whether the actor is part of the performance, or watching the performance.

Heile plays up the non-narrative aspects of the film in his discussion, but he might go a bit too far. He notes the use of water sounds as the actor lays out piping, but that the images make clear no water is actually involved.[347] This is true for the scene, but water imagery becomes very important at the film's end, when the actor views himself floating on the ocean, wrapped in tape and cables. Did the actor's efforts to pipe water at the beginning result in him floating away on projected water at the end? While this is not conventionally narrativistic,

345 Heile, 97.
346 Heile, 97.
347 Heile, 97.

there is a possible cause and effect at work. As with the theatrical version, the film is not wholly non-narrative, but the ambiguous nature of cause and effect completely blurs the line between viewer and performer. While the film version may appear to subvert the key issue of the concept of performance in a taped medium, it does parallel the exploration of desynchronized action and sound in the theatrical medium with desynchronized diagetic sound in the film medium. In both cases, it seems that Kagel is looking to muddle the relationship between cause and effect, and connection and disconnection.

Additionally, one cannot help but think about this film in the context of *Impuls unserer zeit*. and the fact that Riedl's soundtrack is almost completely uncoupled from the action on screen. Kagel very likely had seen *Impuls* at some point, and while I have no evidence that he meant it in this way, the film feels in many ways like a parody. Rather than a sleek, state-of-the-art production-facility with engineers working to produce cutting-edge technology, we get a dusty laboratory with antiquated instruments, and a mad-scientist furiously working, all to no particular end. Kagel's setting and activities come across as a funhouse mirror reflection of the Siemens work. Both use a quasi-documentary style, of sorts, but have vastly different goals, with Siemens an attempt at self-definition, and Kagel using some of the outward trappings of this approach in an absurdist parody.

I: Kagel, Mode 2, and the Fate of the Siemens Studio

For commentators who focus on music as an act of artistic creation, the story of the Siemens Studio may seem perplexing. Why spend the considerable time and resources necessary to develop a studio from the ground up, if you are simply going to allow it to languish and fade into disuse within the decade? The best way to understand this is through

the Mode 2 paradigm: one of Siemens's primary postwar priorities was reconstructing the company's image, and part of that, once they had successfully controlled the damage from the company's wartime conduct, they still had to shape the narrative for what the company would be as a global technological presence. The company decided that a promotional film that highlighted the firm's technological capabilities, but could also attract attention as a cultural product, would be the medium by which they announced to the world that they had arrived. The development of the studio, then, had an immediate and clearly understood application, wholly in the context of the film. They assembled the necessary team of technicians and composers in order to effectively create the studio that would be used for a key part of the film. Once this had been accomplished, and the film released, the company naturally tried to make use of the studio, but, strictly speaking, the application for which they developed it had already been completed. Consequently, it was no longer a priority, and their liquidation of the studio, viewed in context, was not surprising.

The goals of Siemens and of the composers were not entirely synchronized, nor were they entirely divergent. Riedl, naturally, had a real interest in creating a quality soundtrack, and his subsequent use of the studio for so many other industry films is a testament to both his skill as composer for *The Pulse of our Time* and to the appeal of the sound world the studio was capable of producing. While Siemens did not necessarily have a direct interest in promoting electronic music, they certainly benefited from renting the studios out to other interested parties, even if they ultimately decided it was not a direction they wanted to focus on. Composers not employed by Siemens were certainly beneficiaries of the studio, for a variety of reasons. For Kagel and others, it was a site unencumbered by the still lingering baggage from the aesthetic disagreements that plagued the Cologne scene, and so represented

a modicum of artistic freedom in ways that other sites did not. Kagel was able to freely pursue his interest in the meta-interrogation of theatricality, and was something of a culmination of many his compositional interests at the time. While he may have been able to pursue this line at other studios, the specific combination of a non-partisan stance and state of the art technology available at the Siemens studio allowed for a unique artistic product.

Finally, the technological advances of the studio have to be considered as tertiary goals for both Riedl and Siemens, and had a lasting impact. As Boulez noted, the automation the equipment was capable of had an important place in future sites, such as IRCAM, and in some ways, the interface represented a more flexible version of the RCA synthesizer. Though Siemens was not specifically in the electronic music business, *The Impulse of our Time* showed they were, as a company, interested in making a cultural impact. Had they opted to follow up their project with a more concerted effort at developing audio technologies, it could have had a more profound effect, both on the development of studio equipment, and on the popularization of electronic music as soundtrack material. That said, this project was ultimately a success for all parties, even if those successes were somewhat narrow: Siemens got their highly regarded soundtrack, which helped with their promotion effort, while Riedl was able to contribute meaningful to the creation and operation of an advanced studio that would prove to be technologically influential. And for Kagel, the studio stands as the location where he would explore and develop a number of the themes that would pervade his work throughout his lifetime.

IV: Toru Takemitsu, Jikken Kobo, and Sony's Sogetsu Studio

A*: Jikken Kobo, Sony, and Recording Technology*

Out of the three case studies undertaken in this dissertation, Jikken Kobo perhaps most explicitly embodies the changing way that people (particularly those in NATO's sphere of influence) began to conceptualize art and knowledge production in the years immediately following World War II. Unlike in Europe and the United States, support for avant-garde music in general (and electronic music in particular) in Japan did not enjoy explicit academic or government patronage, a situation which would have made corporate alliances all the more attractive.[348] Against the backdrop of a conservative academic establishment and a lingering nationalism (which the occupation government was desperately trying to eradicate), Toru Takemitsu and eight colleagues from various artistic disciplines launched Jikken Kobo in 1951.[349] During their first exhibition, group members described their intentions for the organization:

> The purpose of having this exhibition is to combine the various art forms, reaching an organic combination that could not be realized within a gallery exhibition, and to create a new style of art with social relevance closely related to everyday life...[350]

The focus on multi-disciplinary collaboration as a way of breaking through problems posed by conventional ways of exhibiting artistic works is notable. Similarly notable is the group's name, "experimental laboratory." There are few locations that have as strong

348 Miki Kaneda, "Electroacoustic Music in Japan: The Persistence of the DIY Model (blog post)," on UC Berkeley's Center for New Music and Audio Technologies, 12/20/07: http://cnmat.berkeley.edu/user/miki_kaneda/blog/2007/12/20/electroacoustic_music_japan_persistence_diy_model (accessed 8/17/17) - "The practice of electronic music has never had the kind of government sponsorship that Europe has enjoyed, and academia is even less of a home."

349 James Siddons, "Toru Takemitsu," in *Music of the Twentieth Century Avant-Garde: A Biocritical Sourcebook*, ed. Larry Sitsky (Westport: Greenwood Press), 2002, 510. Also see Burt, 39.

350 Taken from *Experimental Workshop: The 11th Exhibition in Homage to Shuzo Takiguchi*, quoted by Toshiko Kakudo in *Confronting Silence*, translated by Yoshiko Kakudo (Berkeley: Fallen Leaf Press), 1995, xi.

associations with knowledge production as the laboratory, and the group framed their goal of "addressing challenges in the contemporary arts through actual practice or experience"[351] as similar to the goals of a scientist or researcher. From the perspective of Mode 2 knowledge production, this is highly significant: group members believed that there were specific problems in the Japanese art world that needed solving, and by creating an interdisciplinary group of participants, their artistic experiments could solve them.

Composers working with the group had little to no formal composition training, which automatically marginalized them in the eyes of the institutional Japanese music community.[352] It makes sense, then, that the problems that members of Jikken Kobo identified revolved primarily around the aforementioned conservative academic establishment. Wrapped up in this conservatism was as the imperialistic rhetoric and overtones that surrounded Japanese art in the years leading up to World War II.[353] Takemitsu and his fellow group members tried to distance themselves not only from the old guard of the academy, but from the nationalistic sentiments that had been so prevalent in Japanese society but were now discouraged in the aftermath of the war. Attitudes against anything that could be perceived as nationalistic transcended overt rhetoric and policies, and extended to traditional Japanese art-forms as well. Larger societal antipathy towards traditional Japanese culture became internalized in many Japanese, including Takemitsu, who later wrote, "Because of World War II, the dislike of things Japanese continued for some time and was not easily wiped out."[354] While he would find his way back to an appreciation of Japanese culture, in part through contact with John Cage, who visited Japan in 1962, Takemitsu and

351 Siddons, 510.
352 Burt, 19.
353 Burt, 19.
354 Takemitus, 53.

the other members were primarily concerned with avant-garde figures outside of Japan, at least in the beginning.

The occupation government was keen to promote alternatives to traditionally nationalistic aspects of Japanese arts and culture, and even though they did not give Jikken Kobo direct financial support, they ensured an environment where artists and musicians had easy access to new styles and trends from Europe and the United States.[355] Jikken Kobo gave a number of Japanese premiers of modern European works, such as Messiaen's *Quartet for the End of Time* (in 1952) and Schoenberg's *Pierrot Lunaire* (in 1954).[356] They also presented a number of original interdisciplinary artistic works, working to create a so-called "'audio-visual' synthesis of the arts."[357] Some of these collaborative efforts involved support from corporate sponsorship. Jikken Kobo's most notable collaboration was with Tokyo Tsushin Kogyo, which would become Sony in 1954.[358] The partnership gave Jikken Kobo access to new technologies and provided performance spaces for them. This relationship also gave Takemitsu access to the recording technology used in his early *musique concrète* works, which I believe had a palpable impact on his treatment of sound, as well as (perhaps unexpectedly) an avenue to explore sounds associated with Japanese traditional music.

Tokyo Tsushin Kogyo (TTK), founded in 1946, developed Japan's first magnetic tape recorder in 1950, and was known as the "G-type" because of its popularity as a recording device for government proceedings, and released an H-type (for home use) soon afterwards.[359] TTK engineers understood that their recorders could have artistic applications, and, in 1953, hired Takemitsu on a part-time basis to compose on their devices, thereby

355 Burt, 19.
356 Burt, 41.
357 Burt, 40.
358 Holmes, 106.
359 Holmes, 106.

testing the capabilities of their technology and creating material that could be used for promotional purposes. Jikken Kobo and TTK entered into a collaborative relationship, with members of Jikken Kobo using them to create artistic works, and TTK providing space to exhibit their creations to the public.[360] For example, in 1953, Jikken Kobo created multimedia works with TTK's "Autoslide," which used pieces of metallic paper attached to magnetic tape to act as switches to change transparencies being projected on a screen, synchronizing the images to taped sounds.[361] In 1956, the group gave its first concert of *musique concrète* created using TTK's tape recorders, which featured music by Toshiro Mayuzumi and Minao Shibata,[362] as well as Takemitsu's *Relief Statique*. By 1958, group members had drifted apart, and Jikken Kobo concerts ceased. The relationship between Sony and Jikken Kobo members continued for over a decade – even after Jikken Kobo became effectively defunct, Sony donated its studio at the Sogetsu Arts Center to the group in 1960, which provided facilities for composers until 1966.[363]

It is not easy to put a monetary value on the relationship, at least from Sony's perspective. They did, however, gain a knowledgable group of testers, as well as a large body of work that could be used to demonstrate their products' capabilities for consumers. In a context wider than immediate commercial gain, Sony could only have benefited from a body of artists who were interested using their products and pushing the new technology's capabilities, as well as public demonstrations of the products they were developing. The fact that a corporation, well on its way to becoming a global leader in consumer electronics, believed it profitable to engage with an avant-guard art collective for research and development purposes

360 Kaneda..
361 Burt, 40.
362 Burt, 18.
363 Holmes, 107.

demonstrates the paradigm of Mode 2 knowledge production at work. This paradigm would not have included Japanese composers without the medium of electronic music.

The benefits for members of Jikken Kobo are easier to assess. Access to state-of-the-art technology helped members to expand and realize their artistic visions. Takemitsu would compose a great number of *musique concrète* works over the course of his career, and he was especially prolific in this medium in the years 1956-60. Though Jikken Kobo was primarily active from 1951-1958, I believe that the the crucible of artistic ideas Takemitsu experienced through his involvement with the group, as well access to technologies which he otherwise would not have had, made the effects on his artistic development and output far outlast the relatively short amount of time that the organization was active.

B: The NHK Electronic Music Studio and Toshiro Mayuzumi

Though there was no official relationship between Jikken Kobo and the NHK, and while the groundwork for Jikken Kobo was laid before the founding of the NHK studio, Jikken Kobo members, including Toru Takemitsu, would later use their electronic music studios, and no discussion of early Japanese electronic music would be complete without its mention.

Many of the most well known names in Japanese electronic composition, such as Minao Shibata and Makoto Shinohara, would make use of NHK's facilities – facilities which were founded and assembled after a group of NHK technical engineers translated the internal mission statement of the Nordwestdeutscher Rundfunk (NWDR) Cologne Studio.[364] The NHK studio opened in 1955, with the following equipment, resembling NWDR's setup: a sine-wave generator, a saw-tooth wave generator (controlled by keyboard), a number of

364 Emanuelle Loubet, "The Beginnings of Electronic Music in Japan, with a Focus on the NHK Studio: The 1950s and 1960s," trans. Curtis Roads, *Computer Music Journal*, 21 no. 4 (Winter, 1997), 11.

oscillators, a 32 band-pass filter bank, a ring modulator, and tape recorders.[365] Composer Toshiro Mayuzumi composed three études using the studio in 1955, loosely based on electronic works by Stockhausen.[366] By 1968, the studio had moved to its present address and expanded, boasting a new range of sound generators, filters, and modulators. Bolstered by state-of-the-art technology provided by Japan's innovative electronics manufacturers, the NHK studio was sophisticated enough for Stockahusen to create *Telemusik* there in 1966.[367]

While Japanese composers used the NHK studios to realize a number of important electronic works, the popularization of recorded composition in Japan started with Mayuzumi's studies at the Paris conservatory, and though Mayuzumi was not a member of the Jikken Kobo collective, the compositional innovations he brought back would profoundly affect composers of the fledgling organization. Mayuzumi went to Paris to study under Tony Aubin.[368] While there, he not only undertook intensive study of the techniques of Varèse, Boulez, and Messiaen, but also visited Pierre Schaeffer's studio.[369] Upon his return to Japan, he brought the medium of *musique concrète* to the attention of Japanese composers with a short work titled *Oeuvre pour Musique Concrète, X, Y, Z* (1953), as well as the first Japanese piece of electronic music, *Shusaku I* (1955). *X, Y, Z* is a three-part work, using assemblages of sounds from airplanes, sirens, and metallurgy factories, added to a chamber orchestra, Gagaku (traditional Japanese court music) ensemble, a theremin, animal sounds, and a twelve-tone cello solo.[370] While it was premiered earlier and brought attention to the medium, Emanuelle Loubet does not believe *X, Y, Z* to be the first example of *musique concrète*

365 Loubet, 13.
366 Loubet, 12.
367 Holmes, 112.
368 Peter Burt, *The Music of Toru Takemitsu* (Cambridge: Cambridge University Press), 2001, 18.
369 Burt, 18.
370 Loubet, 13. Interestingly, the tie between Gagaku and electronic music in Japan seems to be a common thread, and will be discussed later in more depth.

composed in Japan – there is mention of a work that was composed earlier but premiered later, in 1956, created by Yasushi Akutagawa, and performed at a Jikken Kobo concert.[371] This work seems to have been an experiment in the possibilities of magnetic tape and voice, and does not appear to be extant.[372] While their musical activities have not been as exhaustively explored as the formation and musical works of the NHK studio, Jikken Kobo's influence was quite far reaching – particularly for one of the group's youngest founding members, Toru Takemitsu.

C: Takemitsu's Compositional Development and Forays into Musique Concrète

Peter Burt notes that in the space of a few years, from the late 1950s to early 1960s, Takemitsu's instrumental music became "much more radical and experimental"[373] than his previous offerings. I will examine this transition with an eye toward Takemitsu's published thoughts about the nature of sound and music, as well as his *musique concrète* compositions during this period. Burt points specifically to the second movement of *Uninterrupted Rests* (completed 1959) and *Piano Distance* (1961) as being an obvious point of comparison for this stylistic development. Both pieces are relatively short works for solo piano that use similar pitch-class content, and employ comparable systems of proportional notation to emphasize the relationship between sound and silence. However, the aural impression of these two works is quite different, with the earlier work, for all its atonal harmony and sparse texture, still having a more conventional phrase organization, and the latter having a much more developed timbral sensibility. During the year between the completion of *Uninterrupted Rests* and *Piano Distance*, Takemitsu continued his work with tape, and

371 Loubet, 14.
372 Loubet, 14.
373 Burt, 80.

realized two pieces in the Sogetsu Hall studio in Tokyo: *Quiet Design*, and *Water Music*.[374]

Takemitsu's earliest *concrète* works, including *Relief Statique; Tree, Sky, and Birds; and Clap Vocalism,* (each produced in 1956) all use largely unaltered, recognizable sounds, arranged intentionally but more or less unprocessed. *Clap Vocalism* does increase the speed of the tape to alter the source sounds, but overall, the source material is not significantly changed beyond the simplest processing techniques. Takemitsu realized these works as part of larger Jikken Kobo projects, and most began as incidental music for works in other media. Takemitsu's use of processing techniques changed with *Sky, Horse, and Death* (1958), which began as a soundtrack to a radio drama four years earlier.[375] In this work, many of the source sounds for this work are transformed into deep, bell-like timbres, though he certainly does not shy away from using unaltered sounds as well, representing the title with birdsongs, horses' whinnies, and simulated gunshots.[376]

The tendency to embrace more intensive processing of his source sounds for *musique concrète* is particularly evident in *Water Music* (1960), a work in which Takemitsu greatly explores expanded timbral possibilities. I believe that the increased attention to timbre, necessary in creating more heavily processed works, may have contributed to the additional interest in timbral effects in *Piano Distance* (1961) as compared to the second movement of *Uninterrupted Rests* (1959). However, this was not simply a case of one-way influence – the idea that working with tape caused an instant epiphany that would forever alter the way Takemitsu treated sound is far too glib. Rather, the *concrète* works and acoustic works are both manifestations of Takemitsu's developing philosophy about music and the nature of sound, as well as the relationship between western and traditional Japanese music. Recording

374 Siddons, 511.
375 Burt, 45.
376 Burt, 45.

technology allowed Takemitsu an avenue to explore these ideas that would not have otherwise been available.

D: Pitch Structures and Form in Uninterrupted Rests *and* Piano Distance

To understand some of the musical manifestations of this development, it is necessary to examine and compare *Uninterrupted Rests* and *Piano Distance*, which will help to place *Water Music* into the context of Takemitsu's compositional development during this period. *Uninterrupted Rests* gives some context for Takemitsu's acoustic music production in the mid 1950s, while *Piano Distance* shows a sensibility that, while related to earlier works, features a more nuanced treatment of musical aspects like timbre and motive. Because *Uninterrupted Rests* was composed in three movements over a seven year period, individual movements differ substantially in their treatment of form and thematic material. The work as a whole, as with his previous *Distance de Fée*, took its inspiration from poems by Shuzo Takiguchi, reproduced below:[377]

> Of Never Folding Wings
> Callow moth is enduring the weight of the night's colossal bottle
> Transient white statue is frozen from the memory of snow
> The winds perching on gaunt twig are adapting to scant light
> All
> Ever silent spherical mirror on the hill.[378]

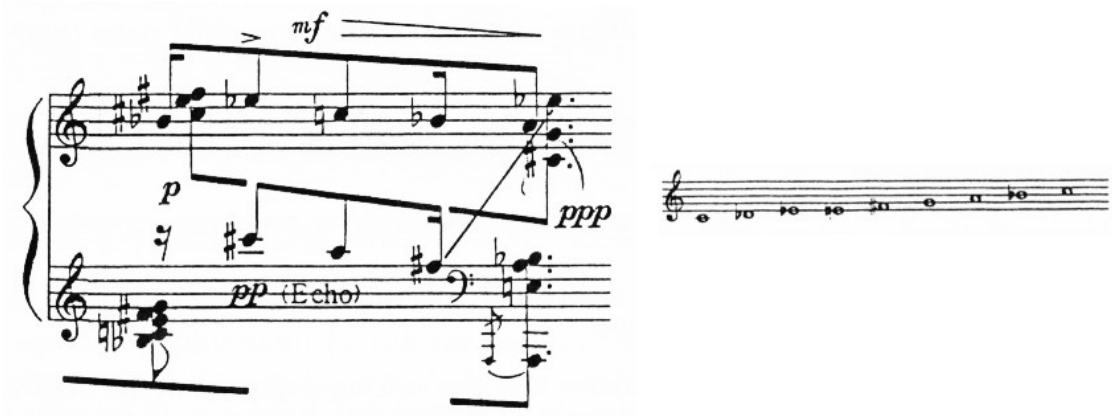
Takemitsu's philosophy in composing these works trends towards the impressionistic. He writes that the setting, "was not an attempt to depict poetry using music as a tool, but an attempt to grasp and convey the beautiful feeling created by the poem."[379] The movements' subtitles help give form to the emotional state they express, and the sense of space created by isolated words in the poem complements Takemitsu's developing sense of emphasizing

377 Noriko Ohtake, *Toru Takemitsu (*Brookfield: Ashgate Publishing), 1993, 78.
378 Takiguchi, "Uninterrupted Rests," translated by Ohtake, in Ohtake, 78.
379 Takemitsu, quoted in Ohtake, 78.

silence.

The first movement, subtitled “Slowly, sadly and as if to converse with,” premiered at an early Jikken Kobo concert in 1952.[380] The musical language of much of the movement bears the hallmarks of Takemitsu's Messiaen-inspired phase, which dominated his early mature compositions.[381] Pitch material is frequently octatonic, and the melodic texture is often one of upper-voice homophonic movement.[382] Noriko Ohtake identifies moments in the work where lines combined to form the pitch collection of Messiaen's second mode of limited transposition (see Fig. 4.1).[383]

Figure 4.1 – Combining Pitches to Form Messiaen's Second Mode[384]



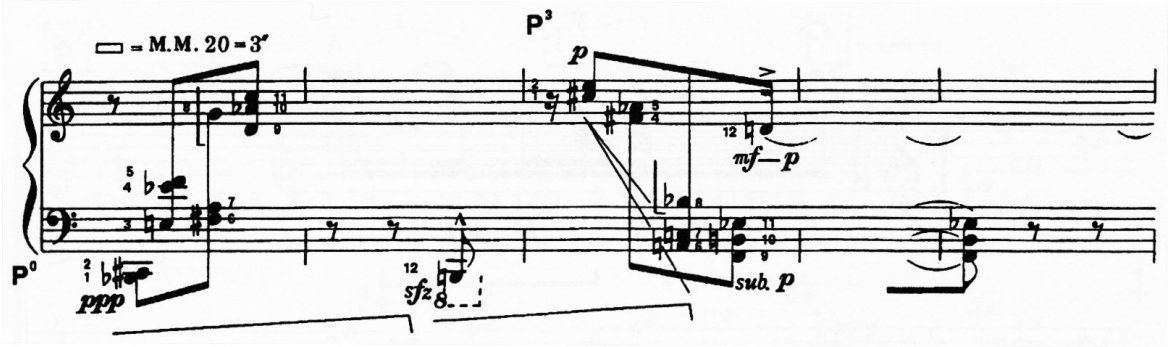
The movement's phrase structure can be parsed according to conspicuous, fairly regularly occurring fermatas. Its large-scale form is a relatively straight-forward binary, with the first phrase of each larger section consisting of literally restated material. This is notable, since within each phrase, musical material hardly ever literally recurs – melodic lines are

380 Burt, 42.
381 Burt, 42.
382 Burt, 42.
383 Ohtake, 79.
384 Taken from Ohtake, 79.

reharmonized, and similar harmonic patterns are used, but the pitch classes are always varied. The thematic repetition is particularly interesting the context of the other pieces in this study, and indeed, even compared to the second movement of *Uninterrupted Rests*, which does not restate any musical material, either in the context of a localized motive or in the context of larger formal units.

The second movement of the work, subtitled "Quietly and with a cruel reverberation" and completed seven years after the first in 1959, has a texture far sparser than the previous movement. Takemitsu employs a proportional notation that calls attention to the space between notes, as well as the sustain of certain pitches over others. Each measure is directed to last approximately three seconds, and so relies on the performer to interpret the piece into a temporal framework. Below is the first line of the movement (see Fig. 4.2).

Figure 4.2 – Proportional Notation and Dodecophonic Allusion in *Uninterrupted Rests*[385]



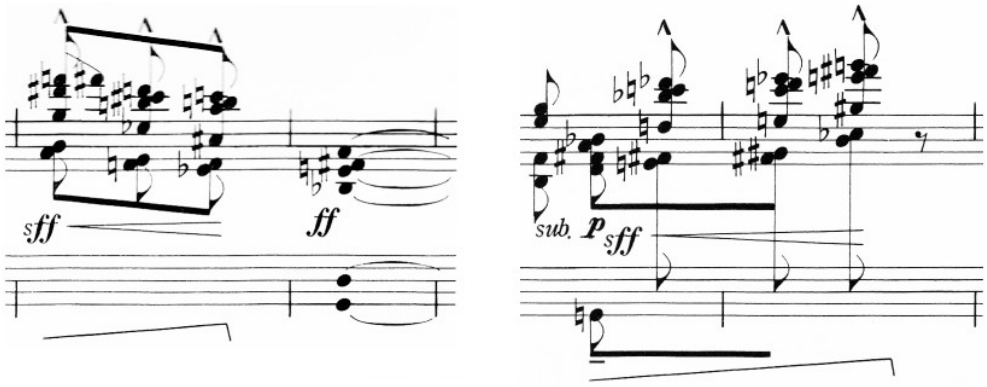
This movement shows a similar treatment of harmonic material to the first. Ohtake identifies much of the musical material as being similarly derived from Messiaen's second mode,[386] and though the movement is not serial in construction, Burt notes "fleeting

385 Taken from Burt, 65.
386 Ohtake, 80.

allusions" to the serial method.[387] Takemitsu uses dodecaphonic principles in the opening bars, beginning with a twelve-tone collection, and is followed by the collection's P_3 form, stated in its registral inverse (see Fig. 4.2).[388]

However, this is as far as the dodecaphonic structure goes; musical material becomes freely organized, though he seems to favor direct transpositions of specific harmonic shapes as a way of generating musical material – for instance on the second page of the work, when distinctive a harmonic complex is repeated in an exact retrograde within an eight measure span (see Fig. 4.3). Unlike the first movement, which features repetition of entire sections, the second movement never repeats an exact vertical sonority, and does not feature wholesale repetition of entire stretches, though does make consistent reuse of precisely transposed chords.

Figure 4.3 – Reuse of Planing Harmonic Material in *Uninterrupted Rests* II



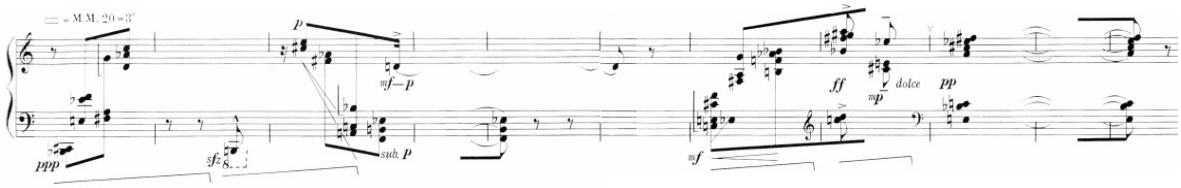
Commentators have noted the more pointilistic, Webernian quality of this movement,[389] particularly when compared to the first. In the second movement of *Uninterrupted Rests*, this helps to bring about a jarring quality. Dissonant chords are struck pointedly and then allowed

387 Burt, 65.
388 Burt, 65.
389 See Ohtake, 80, and Burt, 68.

to decay, while the lack of recurring material helps to create a freely flowing, disjointed feel to the movement, creating an apt reflection of the "cruel reverberation" of the movement's subtitle.

In many ways, the pitch content and texture of the second movement of *Uninterrupted Rests* is quite similar to *Piano Distance*.[390] Both pieces have a free-flowing feel, though *Uninterrupted Rests* features relatively recognizable motivic and phrase structures, which is perhaps what differentiates it most from *Piano Distance*. Though both pieces have similar textures and a nuanced approach to dynamic contrast, in *Uninterrupted Rests* the effect is to create contrast within and between motivic matter, and as we will see, in *Piano Distance*, the effect creates the impression of sonorities emerging from and disappearing into a continuous spectrum, typically in a way that uses motivic material without being based around it. Within the texture of *Uninterrupted Rests*, there is still often an implied, extended musical phrase that functions in a much more conventionally western, cause-and-effect-driven way. This is most apparent in the first movement of the work, which, in spite of its atonality, has aspects reminiscent of a late romantic work. Though the second movement was composed seven years later and differs in form substantially from the first, the traces of a more conventional motivic structure are still present. Consider the first phrase (Fig. 4.4):

Figure 4.4 – First Phrase of *Uninterrupted Rests* II



390 Ohtake, 80.

The initial ascending contour is answered quickly by a downward counterpart, before a second, denser upward contour acts as an embellishment on the first idea. There is something of a short – short – long pattern to the fragments that make up the phrase, similar to a sentence structure. In essence, though the passage employs extreme ranges and (at times) punctuates individual chords, there are still enough artifacts of traditional western-classical phrase structure to affect our hearing. This is far less the case in *Piano Distance*, where musical material is developed in way that functions less around a phrase, and more around the individual qualities of the sound. There is increased attention to motive on a micro level and attacks and decays, which gives a far different impression of the work's musical gestures than those of *Uninterrupted Rests*. Timothy Koozin notes that in *Piano Distance*, "sounds are emphasized through isolation and long duration. This allows time for the timbral quality of a sound and the surrounding silence to become fixed in the listeners' memory."[391] Takemitsu is able to reference previous material through texture, even if the particulars of the material might vary a bit. The difference is readily apparent from the first phrases (see Fig. 4.5 below).

The similarly Webernian texture[392] of *Piano Distance* draws the listeners' attention to the relationship between sound and silence, and much of the work's drama comes from the juxtaposition of dense and sparse textures. As with the second movement of *Uninterrupted Rests, Piano Distance'*s proportional notation again instructing that each measure be played over the course of three seconds. The phrase structure seems almost stream of conscious, in that phrase lengths are irregular and it lacks the references to more conventional antecedent-consequent allusions found in *Uninterrupted Rests*. As with the second movement of

391 Timothy Koozin, "The Solo Piano Works of Toru Takemitsu: A Linear/Set-Theoretic Analysis," PhD diss, University of Cincinnati, 1989, 67.
392 Ohtake, 81.

Uninterrupted Rests, Piano Distance does not seem immediately motivic. There is little repeated material – in fact, there appears to be only one exact repetition of a vertical sonority in the entire work, the significance of which will be discussed later.

While the specific harmonies Takemitsu in *Piano Distance* are a bit different to those used in *Uninterrupted Rests*, there are still ties both to octatonicism and Messiaen's modes. In "Forms of Temporal Experience in the Music of Toru Takemitsu," Tomoko Deguchi identifies the trichords (014) and (026) as being key to understanding the work's form and development, and accounts for them as springing from octatonic scales.[393] While that is true, the harmonies in adjacent sections come from different octatonic collections, so juxtaposed vertical structures will not be from the same scale, and the aural impression of octatonicism is attenuated, though individual chords can be fit into octatonic collections. Regardless, the (014) and (026) trichords clearly play an important role in generating pitch material for the work. Deguchi identifies these groups as "structural sonorities,"[394] and are key parts of her assessment of the developmental scheme of the work: her concept of *transformational motion*.[395] Deguchi believes this idea has its roots in basic concepts in traditional Japanese thought – this will be further explored at the end of the chapter. She relates this scheme to Schoenbergian developing variation, but writes that it differs in crucial ways. She categorizes developing variation as a "thing-oriented" application, operating on specific motives or ideas.[396] The *transformational motion* scheme in *Piano Distance* by contrast, only concerns itself with "relationships between pitches or particular sets of pitches, and how these

393 Tomoko Deguchi, "Forms of Temporal Experience in the Music of Toru Takemitsu" PhD dissertation, University of Buffalo, SUNY, 2005, 132.
394 Deguchi, 129.
395 Deguchi, 128.
396 Deguchi, 131.

relationships are constructed on the surface of the music."[397] What varies is how these relationships are constructed on a phrase-by-phrase basis. In essence, the pitch development hinges on recurring horizontal shapes that we might identify as motivic, but which do not seem to have a developmental goal.

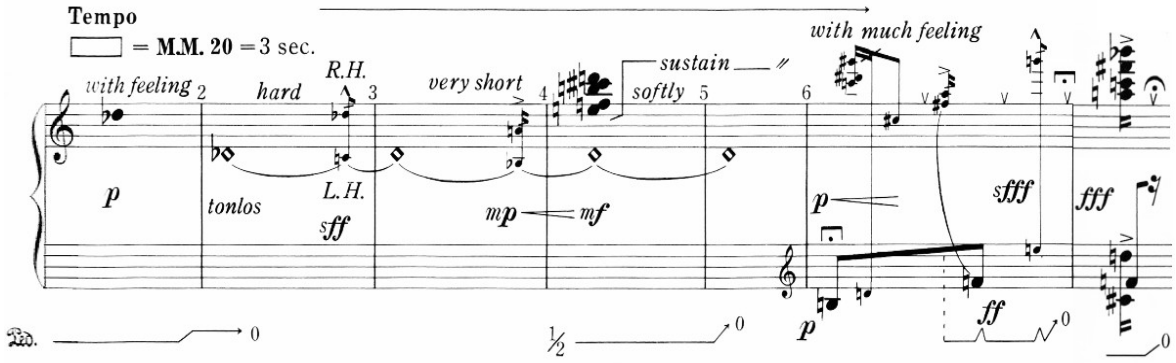
She explains the developmental scheme for the work by identifying melodically stated (014) and (026)-based sonorities, which become verticalized into harmonic complexes. This creates both a harmonic unity and a sense of development without clear trajectory. The harmonic complexes morph into new chords, related to previous harmonies only by their basis in the aforementioned trichords. Pitch content vacillates very quickly between collections, and it ultimately cannot completely account for how we perceive the work. Still, Deguchi's framework may well have provided some measure of structure during the compositional-process.

The idea of *transformational motion* within the context of pitch-class content helps to explain the recurrence and combination of specific set classes in *Piano Distance*, and can be applied to the pitch scheme of *Uninterrupted Rests* as well. However, there are other factors in *Piano Distance* that Takemitsu varies in the work as well: in particular, contour, articulations, and timbral effects. Applying the concept of *transformational motion* to these domains can only bolster Deguchi's argument for the work's developmental scheme, particularly since there are aspects of her analytical approach that raise some questions. Firstly, she uses an intrinsically hierarchical method of analysis to argue for a non-hierarchical structure: in this case a reductive, quasi-Schenkerian approach that relies on privileging specific notes as structurally significant (generally those of the outer voices.)

397 Deguchi, 131.

Deguchi also seems to privilege linear relationships, which creates some difficulties because of the profoundly vertical nature of so many of the sonorities. Picking one note out of a large block chord runs the risk of being unproductively reductive. For example, in her large scale analysis of the complete piece, she reduces the chord in m. 20 that repeats at the very end – the sole repeating harmony in the work – to a single A-flat sonority.[398] Deguchi does not claim that her analysis represents a listener's perception, but because it lacks the disciplined, systematic methodology of Schenkerian reductive strategies, it runs the risk of over-privileging less germane aspects of the work. Deguchi's analysis of the first two phrases (as she defines them, typically based in moments of silence or repose) of the work shows both the strengths and weaknesses of her approach. Below is the passage in question (see fig. 4.5).

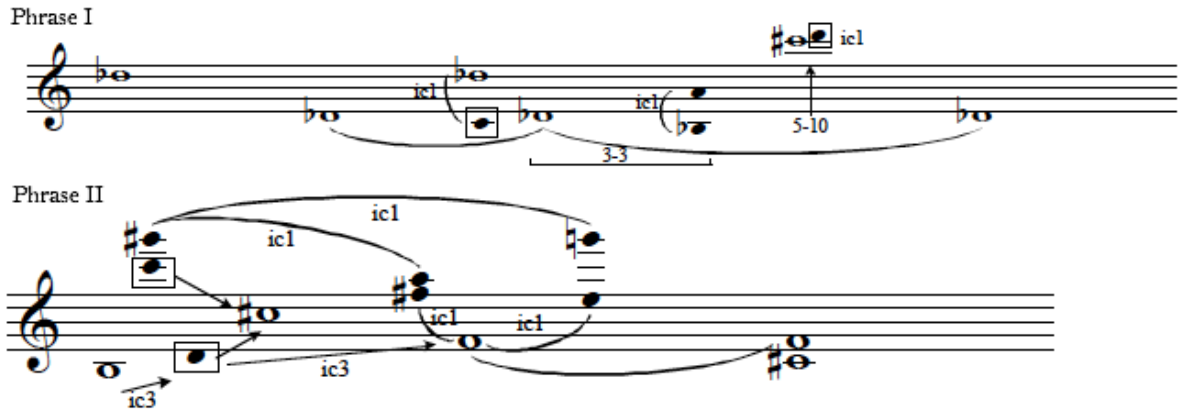
Figure 4.5 – Opening Phrases of *Piano Distance*



Deguchi draws the break between the two phrases after m. 5, the first moment of total silence in the work. Her reductions of these phrases follow (see fig. 4.6)

398 Deguchi, 127.

Figure 4.6 – Deguchi's Analysis of the Opening Phrases of *Piano Distance*



There are many parts about this analysis that are useful in understanding how Takemitsu develops pitch relationships, showing the frequent recurrence of ic1, as well as the prominent Db/C# which changes register through the two phases. However, the strongly linear aspect of this style of analysis has to potential to miss conspicuous sonorities. For example, Deguchi reduces out the B and F natural in the large chord in m. 4 that ends the first phrase. Since the longest and lowest notes starting the second phrase are a B and F (the D in the middle should be grouped with the other notes in the right hand to which it is barred – it is simply a case of registral displacement), the inclusion of these pitches seems potentially significant.

The biggest drawback to this approach, however, is the lack of representation of rhythmic and timbral effects that have such an important role in this work's identity. For example, in both phrases, there is a relatable scheme of attacks and density that helps to structure how we hear the passage. Both passages start with single pitches and end with larger chords (mm. 4 and 7). Before each larger chord, there are sharply attacked, registrally displaced ic1 dyads (the end of mm. 2 and 3 in the first phrase, and the end of m. 6 in the second). The second phrase differs from the first in its abbreviated duration (six seconds instead of 15), and its

expanded use of grace notes. However, this section sees a similar pattern of longer notes, sharp attacks, and and increase in harmonic density at the end of each phrase, which helps to tie the phrases together despite their asymmetric lengths – these techniques will be discussed in more depth later. As musical aspects such as pitch density, articulation, and dynamics are arguably more salient to an average listener than abstracted pitch-class groupings, these aspects must be addressed. While Schenkerian approaches necessarily deemphasize timbral and textural concerns, they do so because they emphasize a certain method of understanding tonal development. The sometimes ambiguous nature of what pitches should be considered structural, combined with the many other musical aspects at play in *Piano Distance,* means that trying to create an ad hoc Schenkerian reduction misses much of this work's complexity, as well as aspects of the works transformational scheme. For instance, consider mm. 24-33, shown in Fig. 4.7 (in Deguchi's phrase organization, this is phrase V and the beginning of phrase VI).

Deguchi's analysis of this section is shown below (see fig. 4.8). The analysis does well at showing an underlying presence of prominent interval classes, as well as the (026) set that underpins much of this piece's harmony. However, I find the emphasis on the A (mm.28-30) to the exclusion of the other pitches in the passage a bit problematic. While the A is a sustained pitch that has a grounding effect on the passage (very much akin to the Db at the beginning), highlighting this fact is accomplished by omitting much of the contour transformation that drives the work's development, and I am unconvinced that the A can be meaningfully separated from its surrounding motivic content.

Figure 4.7 – mm. 24-33 of *Piano Distance*

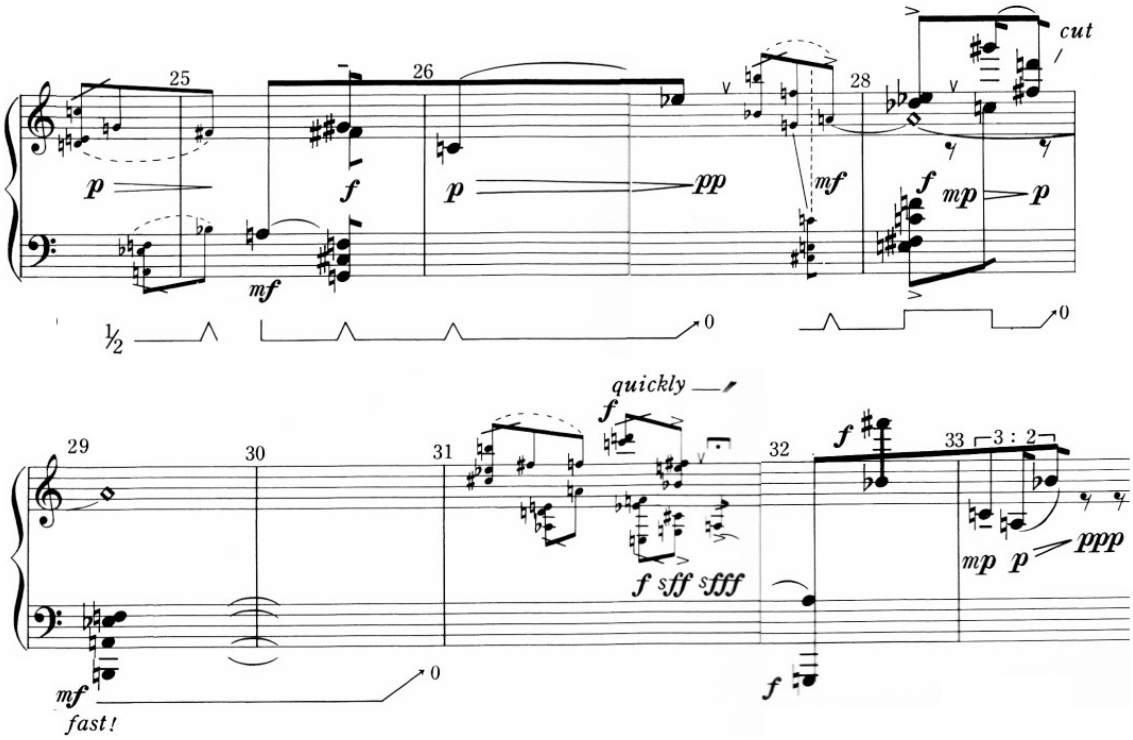
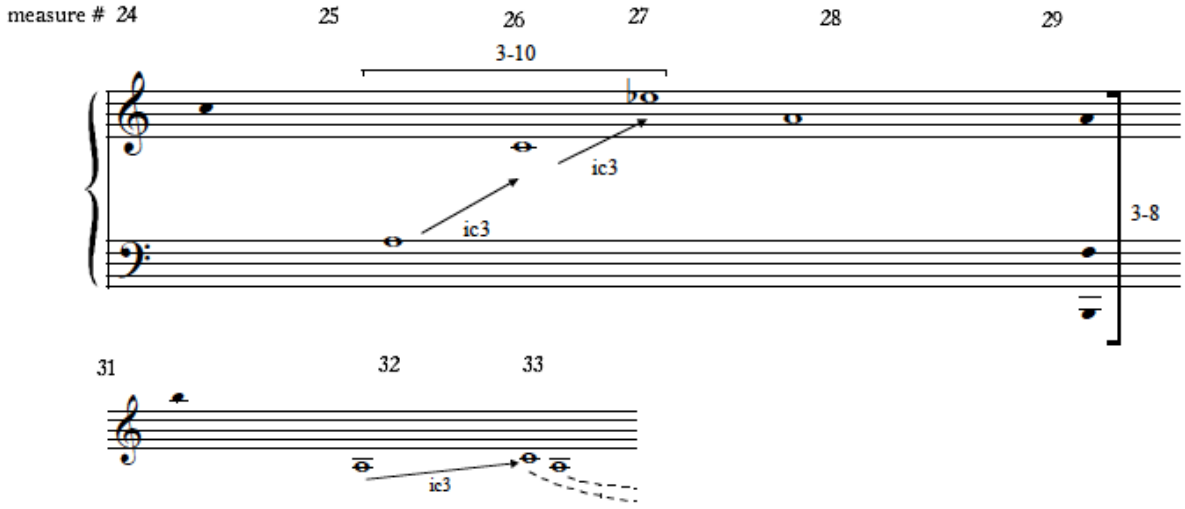
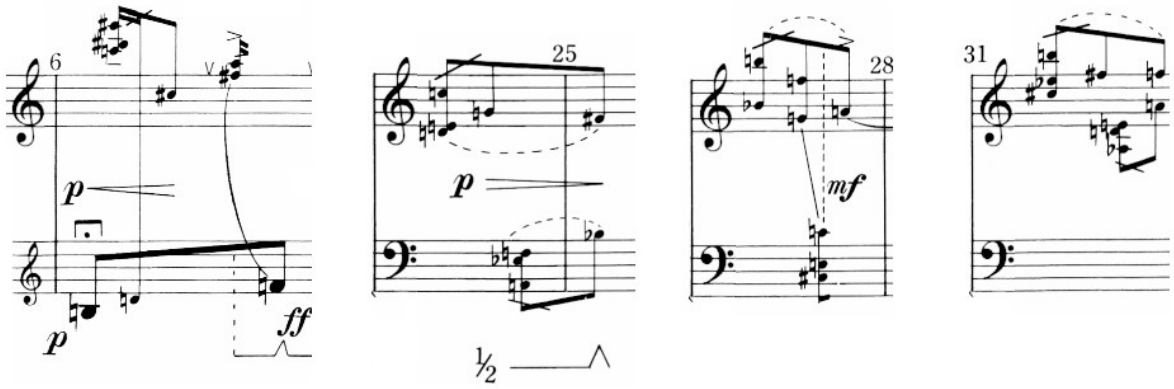


Figure 4.8 – Deguchi's Reductive Analysis of *Piano Distance*, mm. 24-33



In this passage, I believe that motive can play a fruitful role. For example, the small noteheaded motives in mm. 24 and 31 are exact transpositions of each other (Deguchi acknowledges this, but it doesn't play a role in her analysis other than to signify the beginning of a new phrase). The motive in the second half of m. 27, while not a transposition, is still very much related to these gestures – as with the other two, there are four attack points, the third of which is much lower in register than the other two. The contour of the top voices is the same in each case, and they are all notated similarly. All three motives also share a similarity of shape with the gesture in m. 6. These fragments are shown side-by-side in fig. 4.9.

Figure 4.9 – Motivic Fragments in mm. 6, 24, 27, and 31 of *Piano Distance*



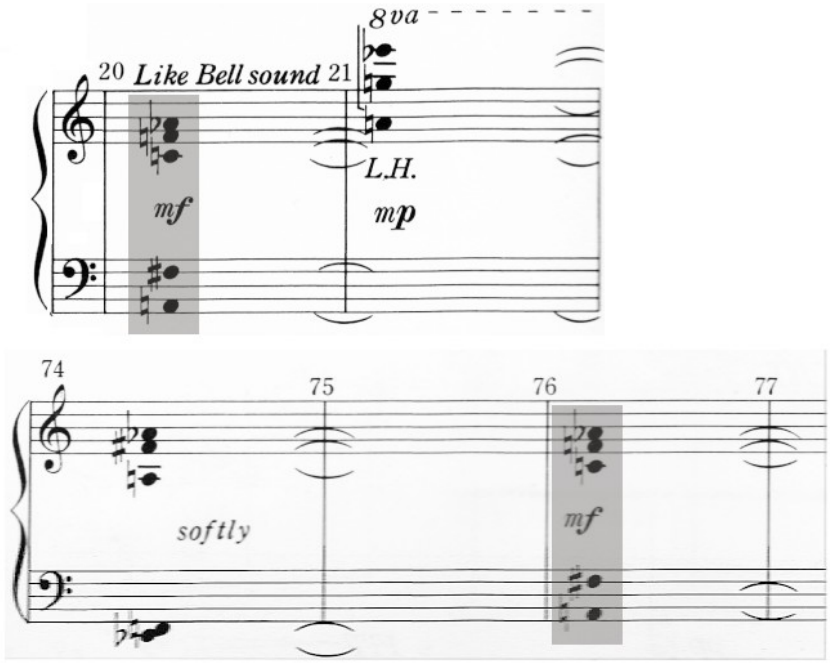
While the motive in m.6 is significantly different from the other three, the combination of a short descent (seen in the right hand of each example, usually consisting of three notes) and a registrally displaced (low) attack, ties these motives together even if their pitch content can be difficult to relate. While pitch is an crucial factor in the large scale choices of sonorities, the transformations that take place in this work happen in a number of different domains, with the end result featuring a freely-flowing exploration of a variety of musical

material. This type of motivic variation becomes quite important in Takemitsu's treatment of sonorities in *Water Music*.

Though the organization of this work's structure lacks the strict hierarchical organization of tonal music, or even the implicit, row-centered organization of the twelve-tone method, it is important to note that the organization is not random, and Takemitsu clearly emphasizes specific sonorities. First, as mentioned above, only a single vertical sonority repeats in the work, first appearing in m. 20, marked to be articulated with a "bell-like" attack, and finally being restated as the last sonority in the work in m. 76 (see Fig. 4.10), a statement of [5,6,8,9,0], prime form (01347). This sonority includes both (014) and (026) subsets, which is significant given the aforementioned prominence of these collections in structuring the work's harmonies. While this links the sonority to other material throughout the piece, it is not unique in having this property. Several commentators have remarked that there may be "landmarks" which serve as points of reference within the formal scheme of a number of Takemitsu's works, including *Piano Distance*.[399] The recurrent use of (01347) may well be this type of landmark, which gives focus to a work that otherwise has little recurring material.

399 Burt, 81.

Figure 4.10 – Recurring Sonority in *Piano Distance*, mm. 20 and 76



Assuming this repeated sonority is significant, it is also significant that there doesn't appear to be a clear development towards the chord, either to establishing the sonority in the first place, or an extended, trackable effort to reestablish the sonority at the end of the work. Even so, it seems notable that the sole recurring sonority ends the piece, which creates a temptation to label it as something of a culmination. In 1962, Takemitsu described the process of composition: "the external and internal world is full of vibration. Existing in this stream of infinite sound, I thought that it is my task to capture a single defined sound."[400] Not only can this be understood as an approach to composition in general, this also seems a particularly apt way of understanding the significance of the recurring [5,6,8,9,0] chord. The sound world Takemitsu creates in *Piano Distance* is one of related but disparate and motives, arising from and disappearing back to silence. Different versions of a similar idea (as shown in fig. 4.8) are made manifest, with the impression that the musical fragment is gradually coming into focus. Against the backdrop of a stream of tangentially related harmonies, a

400 Toru Takemitsu, from "A Composer's Diary" (1962), in *Confronting Silence*, translated by Yoshiko Kakudo (Berkeley: Fallen Leaf Press), 1995, 8.

single chord sounds. The signi ficance of the “bell-like” chord cannot be understood at the time, other than that its length of sustain makes it seem more deliberate than the preceding, more hectically-paced phrase. Its importance lies in its re-emersion from the sea of sonic possibilities that makes up the bulk of the work.

The other factor that points to a specific, large-scale ordering of events is the general scheme of harmonically dense moments increasing in intensity through the course of the work, implying a pattern of less dense to more dense within the piece's phrase structure. The beginning sets up this pattern very clearly: it begins with a single held pitch, and while there are other instances of single pitches being played, this is the longest time a single note is sustained in the work (by Takemitsu's instructions, a little over 3 seconds). From a single note, the piece progresses in a general scheme of juxtaposing spare textures and silence with moments of increasing harmonic density. This is particularly apparent through the first half of the work (see the spectrogram of this piece, Fig. 4.12). From 51 to 140 seconds, the moments of harmonic density build in intensity. Similarly, there is a general build in intensity from 230 seconds to the end of the piece. While the idea of a hierarchy is undermined by circumventing regular phrase lengths and conventional antecedent/consequent relationships, the trajectory of density and restatement of the [5,6,8,9,0] chord show an intentional large-scale plan; the work is not meant to be pseudo-aleatoric. That said, within the scheme of increasing harmonic density, there is a tendency to create an impression of non-recurrence over the course of the entire piece. While the first half of the work seems to show a clear increase in harmonic density, one could also view the piece as being bisected at roughly 130 seconds. This second half of the piece seems to abandon much of the motivic development seen fig. 3.9, instead being organized in loose parallel by alternating similarly constructed lines of running chords (beginning m. 39, and again in m. 64), punctuated by much sparser stretches. The comparison of the running lines can be seen in fig. 4.11.

Though the pitch content and chordal structures of *Uninterrupted Rests* and *Piano Distance* is fairly similar, they are applied to very different ends. *Uninterrupted Rests* is ultimately a collection of character sketches showing sometimes overt references to earlier classical phrase structures, while *Piano Distance* is a much more nebulous exploration of sound and silence. This difference is reflected and reinforced by Takemitsu's varied treatment of motive, timbre, and expression in the two works, which I believe is at the crux of his compositional development during this period.

Figure 4.11– Running Lines in the Second Half of *Piano Distance*

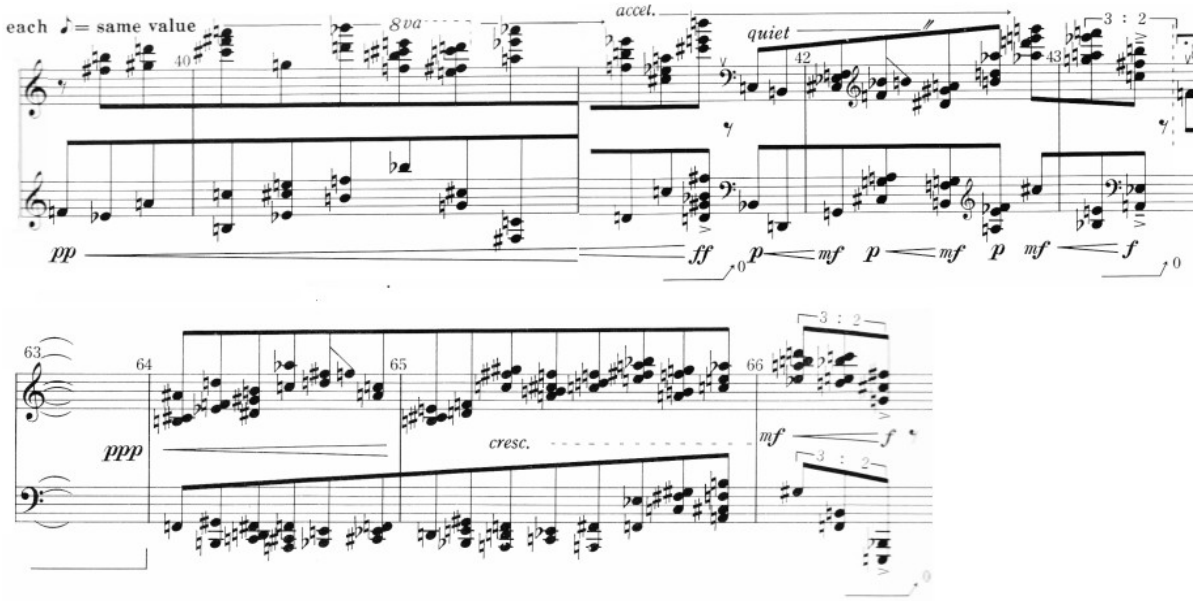
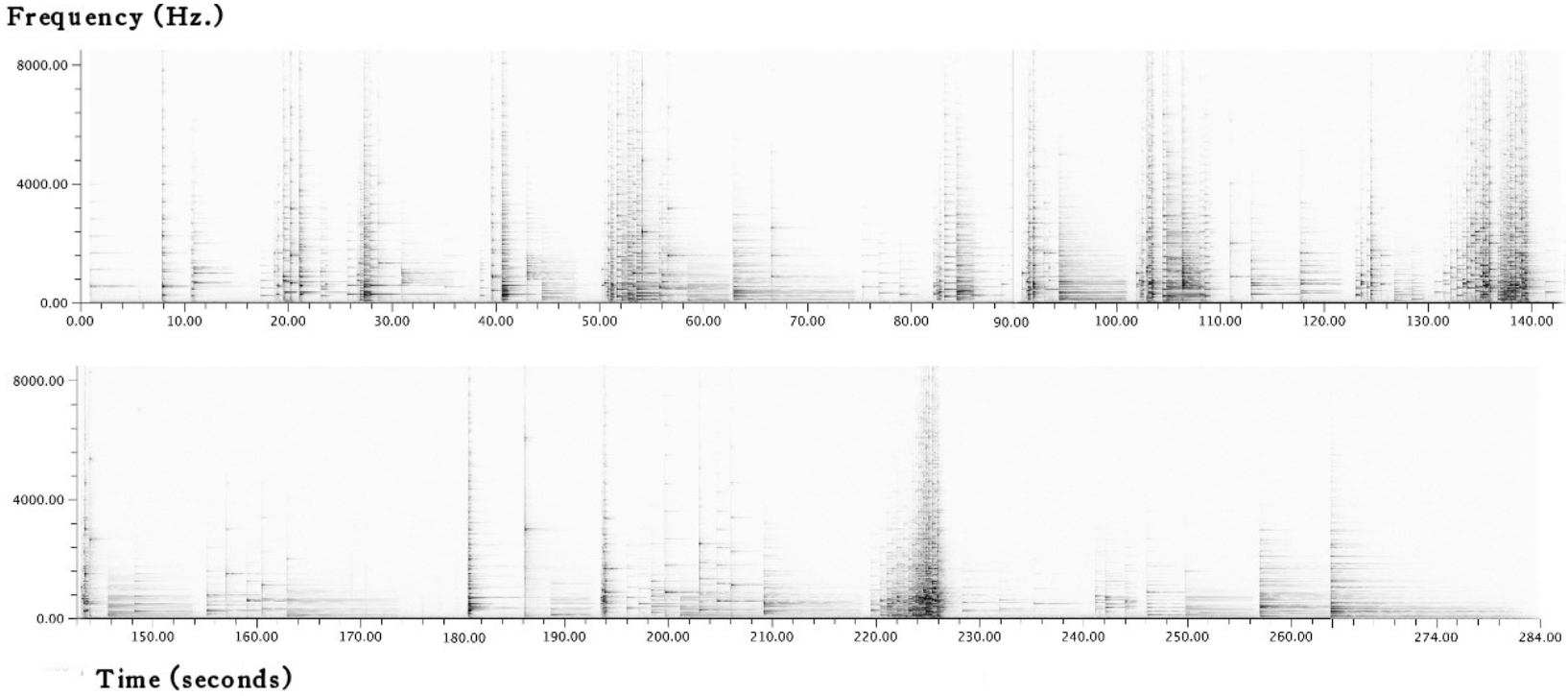


Figure 4.12 – Spectrogram of *Piano Distance* as Played by Yuji Takahashi



E: Timbre and Philosophy in Uninterrupted Rests *and* Piano Distance

Much of my case for Takemitsu's stylistic development between *Uninterrupted Rests* and *Piano Distance* revolves around an increased sensitivity to expression and timbre, which point to subtle changes in Takemitsu's style during the late 1950s to early 1960s. Given his writings at the time, it seems these changes are entangled with a growing tendency for using his compositions to explore and reflect on the abstract nature of sound.

While the interpretive instructions for *Uninterrupted Rests* do not show the same preference for subtly shaping the sonorities as *Piano Distance,* they are nonetheless nuanced and effective in the purpose of reflecting the "beautiful feeling"[401] conveyed by Takiguchi's poem. In both the first and second movements, the impression of the dynamic scheme is one of juxtaposed contrast. The second movement contains what may be another oblique reference to serial practices: Takemitsu employs twelve dynamic variations from *pppp* to *sfff*, though they do not appear to be part of an actual serial organization.[402] For all of the different levels of dynamic intensity, there are comparatively few crescendos and diminuendos, so the suddenness of dynamic change is always apparent. The stark dynamic contrast of the piece helps to create a feeling of disjunction within the musical statements, which is an effective way of representing the rapidly shifting imagery of the original poem. The effects Takemitsu employs in *Uninterrupted Rests* are in service of the impressionistic nature of the work. *Piano Distance*, by contrast, has less concrete associations.

The title itself might be thought of as relating to the space that the sound traverses. Regarding the title, Takemitsu writes that it "does not have any profound meaning to it . . . it could be interpreted as expressing the various and multiple tones of the 'piano' (soft

401 Takemitsu, quoted in Ohtake, 78.
402 Burt, 66.

dynamics)."[403] The "distance" in this model, then, could be construed as the distance between different dynamic levels and timbres: the gulf that the sound traverses in its becoming another sound. Manipulation of these parameters can create both the impression of a physical distance, as well as a nearness or farness in sound quality.

Other commentators have also noted the importance of timbre in appreciating the work. In his program notes for a performance in 1989, Joel Sachs writes that the piece focuses "upon the transformations that a sound undergoes while being sustained on the piano."[404] Under both Takemitsu's explanation and Sachs's interpretation, the transformation of sound is one of the piece's key aspects. There may also be a more literal reading of the title, relying on one of the most carefully demarcated aspects of expression in the score: pedaling instructions. The specificity of these instructions, in combination with the precise dynamic directions, helps to create different degrees of the impression of reverb, which in turn creates an illusion of different physical distances between the listener and the sound source.

The timbral effects that Takemitsu employs in *Piano Distance* are quite involved, and, in addition to the usual techniques to control expression and timbre (such as crescendos and diminuendos, volume markings, and standard articulations), are generally accomplished by three different means. The first is through the aforementioned pedaling instructions, using a graphical notation to show different gradations and release points. The second is through keeping keys depressed, or pressing and holding keys without sounding them in order to create sympathetic vibration in other strings, adding to a chord's overtones. The third way is the peculiarly specific expressive instructions that Takemitsu employs, which often seem oxymoronic, and have the effect of shaping a tone's attack or release points (for example,

403 Takemitsu, quoted in Ohtake, 81.
404 Joel Sachs, quoted in Ohtake, 81.

"Tenderly hard"). Through this mix of subjective and objective instruction, Takemitsu implies a specific set of sonorities, while at the same time relying on the pianist's interpretation. That Takemitsu was willing to trust a performer to interpret such specific instructions faithfully is notable. Unsurprisingly, at the time of the composition of *Piano Distance*, Takemitsu was used to working with a specific pianist, Yuji Takahashi (himself a composer and future Xenakis pupil) who also premiered *Corona* and *Arc* (1962).[405] According to Ohtake, "Takemitsu's confidence in this pianist is proven in *Corona* and *Arc* with which their aleatoric elements depend greatly on Takahashi's talents."[406] While the three elements are present through the entire work, they are perhaps especially overt in the first few measures of the work (Fig. 4.5). It might be difficult to see exactly what sonic effects Takemitsu's exacting notation helps to bring about. As Deguchi points out, the Db sustained through this passage helps to create some measure of aural grounding to the phrase. The Db is the first tone heard, and is allowed to decay gradually back into nothing through a slow release of the sustain pedal. The second sound is not sustained by pedal, but by holding down the lower Db, the upper Db can continue to reverberate while the C (which does not vibrate sympathetically with the Db) dissipates. Takemitsu complicates the initial Db sonority, but still allows it to remain most salient – this would not be the case if he had simply pedaled the entire sonority. Takemitsu further obscures the D-flat sonority before reasserting its presence as part of a larger block of sound at the end of the passage (this time stated as a C-sharp). Interestingly, D-flat never again functions as an aural touchstone in the work. By the second phrase, its role is replaced by D-natural, which again gives way and never regains prominence. By the second half of the piece, there are no more pitches with the same aurally

405 Ohtake, 68.
406 Ohtake, 68.

dominant role as those found in the first half, again reinforcing the implied bisection discussed above, and creating an impression of transience.

Takemitsu's timbral techniques do more than simply work to assert a prominent sonority; they affect the basic nature of how the sounds in this passage arise, decay, and lead into one another. The precise pedaling in m.6, for instance, ensures that each sonority is allowed to speak, rather than being partially swallowed by the previous sounds. The more subjective expressive instructions also frequently affect a sonority's attack and decay. For example, the first iteration of the recurring chord, m. 20, as shown above (fig. 4.10)

The instruction, "Like Bell sound" gives a clear image for crafting the sound – presumably, a somewhat sharp attack, with a gradual decay, leading into a new sonority in a higher register – in this case, the (01347) chord gives way to (0236), both of which have (014) and (026) as subsets. When the chord recurs as the last sonority of the piece, this expressive instruction is conspicuously lacking. The bell imagery's significance has many possible explanations. There is an inherent similarity between the shapes of the sound when striking a piano and striking a bell: a sharp attack followed by gradual decay, so if one is going to try to imitate a non-piano sound with the piano, a bell is a likely choice. Perhaps more to the point, though, bells hold an important place in Japanese Zen Buddhism. According to Daisetz Teitaro Suzuki, a general "Prayer of the Bell" is recited each time monks strike the temple bell.[407] According to Suzuki, "Each sound emitted by the bell is the voice of Kwannon calling on us to purify our sense of hearing, whereby a spiritual experience called 'interfusion' will finally take place in us."[408] In essence, the sound of the bell acts as a catalyst to remove the barriers between the senses. Given Zen's prominence in

407 Teitaro Suzuki, *Manual of Zen Buddhism*, 1935, http://www.sacred-texts.com/bud/mzb/mzb01.htm (accessed 11/19/13)

408 Suzuki, http://www.sacred-texts.com/bud/mzb/mzb01.htm (accessed 11/19/13).

Japanese philosophy, it is likely Takemitsu would have known the bell as an important image, even if he was not a practicing Buddhist himself.

As the lone recurring sonority in the work, the bell-sonority merits close attention. The piece's trajectory, with the bell-sound occurring at the approximate end of the work's first quarter, followed by a number digressions and new but related sonorities invites a number of possible interpretations. Leading up to its first statement, the musical material is quite hectic, with rapidly changing harmonies that one can read as a number of different (014) and (026) configurations. The bell sound manifests itself from the established soundscape, stated as the first non-stemmed harmony in six measures (with therefore more conceptual weight than its surrounding pitches), and is held the longest any single harmony lasts to that point in the piece, slowly decaying for a full three measures, or nine seconds. While the previous phrase gives a number of expressive instructions, they are all somewhat nebulous: “strong,” “tenderly hard,” “softly,” and “sustain.” The chord in m. 20 has the most specific interpretive instruction in the entire work. From this angle, it seems that Takemitsu frames the bell-like sound as the most concretely defined sonority in the piece.

Given its singular status in the work, there are a number of readings for the significance of the bell-sound: as a bell is struck and then rings, the material between the initial strike and the final reiteration could be conceived of as reverberations, since the harmonies all spring from the same pitch class groupings, and are explorations within the same sonority. This interpretation frames the key “distance” in the work as the distance between the two identical sonorities. The drawback to this interpretation is that accounting for the material before the bell-tone is problematic. I tend to prefer a somewhat vaguer reading of the work: keeping with Takemitsu's statement about capturing “a single defined sound,” he states that sound

with the clarity of a bell, realizing that it will disperse into the field of possibilities. The statement at the end simply redefines the sonority, affirming its capture. The other bits of micro-level motivic development, as well as the overall increase in density, are part of the multi-dimensional digressions surrounding the key sonority of the work.

The same timbral sensitivity and unconventional formal characteristics that pervade *Piano Distance* can also be found in *Water Music*. This might be expected, considering the nature of *musique concrète*, which, since it uses unconventional sounds, promotes a different vision of musical construction. Takemitsu quotes Pierre Schaeffer in describing the difference between the two mediums: "Conventional music expressed concrete images by means of abstract musical sounds. Conversely, *musique concrète* tried to express an abstract image by means of everyday concrete sounds."[409] The exact nature of the connection between the musical languages of Takemitsu's more developed *concrète* works and the more conventional acoustic works he wrote concurrently or afterwards is difficult to discern. The ties between the aural effect of the works, however, are clearer. In addition to similarities in how timbre Takemitsu treats timbre, both types of works often focus on motivic development on a micro-level, and the interaction between sound and silence, traceable through a broader application of Deguchi's *transformational motion*. Though electronic and acoustic media are fundamentally different in some ways, the idea is still fairly easily applicable, since Deguchi positions *transformational motion* as being an essentially traditional Japanese philosophical idea, not necessarily tied to a particular medium. She quotes scholar Masao Maruyama:

409 Takemtisu, 28.

> The non-hierarchical nature of phrase relationships in Takemitsu's music seems to precisely embody Maruyama's idea of a uniquely Japanese style of thought . . .while in *Piano Distance* we may perceive an antecedent-consequent relation between two phrases, this impression quickly collapses as the consequent phrase itself becomes an antecedent.[410]

Deguchi ties her concept of *transformational motion* to specific aspects of Japanese traditional philosophy: "naru, tsugitsugi, and ikioki," roughly translated together as "force that becomes one after another."[411] These ideas relate to the Japanese conception of the creation of the world: in contrast to Abrahamic religions' belief in a creator, this tradition holds that the world "becomes," without a particular creator-figure.[412] The *naru* of this sequence can be translated in multiple ways ("become" used here,) but always, "suggests the Japanese inclination to the autonomous alteration of matter as time passes . . . the concepts of world and history are viewed as 'continuous' streams of 'becoming.' The concept of 'continuous becoming' is reflected in many systems of Japanese society."[413] In *Piano Distance*, each phrase "becomes" or "transforms continuously with the autonomous alteration of musical events."[414] Such a philosophy could be applied to many types of music, and is useful in appraising *Water Music* as well.

F: Water Music *(1960)*

The features that so differentiate *Piano Distance* from *Uninterrupted Rests* are by and large also hallmarks of *Water Music* – treating natural sounds as musical material necessitates paying close attention to non-pitch elements during the compositional process.

410 Deguchi, 132.
411 Deguchi, 87.
412 Deguchi, 98.
413 Deguchi, 99.
414 Deguchi, 133. As a caveat, I would add the term "seemingly" in there, since indeed, the music is not autonomous – Takemitsu composed it. Still, the description is apt, and the music does give a very different impression to more overtly goal-oriented, hierarchical works.

Takemitsu describes his vision of *musique concrète* as being essentially the same as that of Pierre Schaeffer (and quite similar to John Cage, for that matter), though they came upon their ideas independently. Takemitsu writes:

> It came to me as a revelation: bring noise into the realm of organized music. I recorded various sounds and frequencies on tape. Surrounded by these random sounds I found they triggered emotional responses in me, which, in turn, I preserved as a sound on tape . . . In 1948 the French composer Pierre Shaeffer first composed *musique concrète*, based on the same ideas as mine. This was a happy coincidence for me. Music was changing, slightly perhaps, but nevertheless changing.[415]

Though Takemitsu had the same battery of processing techniques available to him as Pierre Schaeffer, their preferences for sound manipulation varied. While Schaeffer worked to "abstract the sound from its dramatic context and elevate it to the dignity of musical material,"[416] Takemitsu, as might be expected given his thoughts outlined above, was quite pleased to use undisguised sounds in his compositions.

Takemitsu's writings tend to emphasize the link between sounds in nature and composed music. This is not necessarily linked specifically to electronic music or *musique concrète* – noting that "Music will never become new simply by new sounds or by enlargement of the medium."[417] Takemitsu saw nothing intrinsically different about music in the electronic medium, rather, it was a gateway, allowing the composer to draw a listener's attention to the inherent musicality of sound. Takemitsu ties this heightened appreciation for the nature of sound to John Cage, saying:

> John Cage profoundly influenced my music . . . (he) speaks of the "insides of sounds." This may seem like mysterious talk, but he is only suggesting that we include all kinds of vibrations in what we accept as a musical sound . . . Listening to his sounds is what John Cage's music really is. That is what any music is.[418]

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415 Takemitsu, 82.
416 Pierre, Schaeffer, quoted in Burt, 44.
417 Takemitsu, 28.
418 Takemitsu, 27.

Takemitsu also connects the idea of getting to the insides of sounds to the measured way that time is traditionally represented in Western music, writing:

> Western music has been carefully classified within a narrow system of sounds . . . Rests within a score tend to be placed with mathematical compromises. Here the sound has lost its strength within the limitation of functionalism. Our task is to revive the basic power of sound. This can only be done by a new recognition of what sound really is.[419]

His critique of the traditional Western conception of sound seems to focus on two aspects: an objection to constraining sound and silence by fixed hierarchical relationships, and the limitations of using conventional instruments. Both of these aspects of Western music tended to obscure "getting inside the sound." Though Takemitsu would go on to write for conventional instruments in conventional notation, so there was nothing intrinsic about these conventions that prevented what he sought to do while composing. However, there was something inherent about these conventions that encouraged listening and composing in a specific way that he sought to overcome. He would later identify traditional Japanese music as a source for ideas in overcoming some of the problematic aspects of this mode of listening,

Takemitsu credits his rediscovery and appreciation for Japanese traditional art-forms to exposure to John Cage, whose ideas he was already absorbing by 1956.[420] Takemitsu never makes exactly how and when his journey back to appreciating Japanese traditional culture through Cage occurred, but is explicit in his crediting, writing, "I must thank John Cage, because he shifted my attention to the positive sides of Japanese culture; I had long regarded 'Japan,' and anything related to it, as things that are supposed to be rejected."[421] Takemitsu

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419 Takemtisu, 7.

420 Burt, 92.

421 Toru Takemitsu, *Tooi Yokigoe no Kanata e,* translated by Mikiko Sakamoto (Tokyo: Shinochosha 1992), 28, quoted in Mikiko Sakamoto, "Takemitsu and the Influence of "Cage Shock.*"* DMA document, University of Nebraska, Lincoln, 2010.12-13.

writes that he had heard about Cage shortly after the war through the "intellectual antennae" of Shuzo Takiguchi and Kunihara Akiyama.[422] The Jikken Kobo concerts of the mid-1950s exhibited some "Cagean" ideas,[423] but the bulk of Cage's influence probably happened after Takemitsu's colleague Toshi Ichiyanagi returned from study in the United States in 1961 – during Cage's composition seminars taught at the New School during the late 1950s, Cage specifically singled out Ichiyanagi's composition *Distance* for "special approbation."[424]

There is some evidence that Takemitsu's attitude towards aspects of traditional Japanese culture were changing even prior to Ichiyanagi's return, and it seems likely in any case that such a journey would be more of a gradual process with a variety of influencing factors than a than a bolt of lightening. Takemitsu was introducing the sounds of every day life into his compositions by 1948,[425] before he was familiar with either Cage or Pierre Schaeffer, so it doesn't seem a case of direct influence so much as these composers giving form to ideas and impulses already present in Takemitsu's thoughts and music. The relationship between early electronic music and traditional Japanese music involves more composers than just Takemitsu; Japanese electronic composers working at NHK studios also seem to have been inspired by traditional Japanese aesthetics. The rediscovery of Japanese traditional music and culture by member of the avant-garde will be more comprehensively explored at the end of this chapter.

Realized at Sony's Sogetsu studios, *Water Music* was one of two *concrète* works Takemitsu composed in 1960, and one of the first he wrote that was not initially conceived of

422 Takemitsu, 137.
423 Barry Shank, "Productive Orientalisms," in *Postnational Musical Identities: Cultural Production, Distribution, and Consumption in a Globalized Scenario*, ed. Ignacio Corona and Alejandro Madrid, (Lanham: Lexington Books, 2008,)52.
424 Shank, 51.
425 Shank, 51.

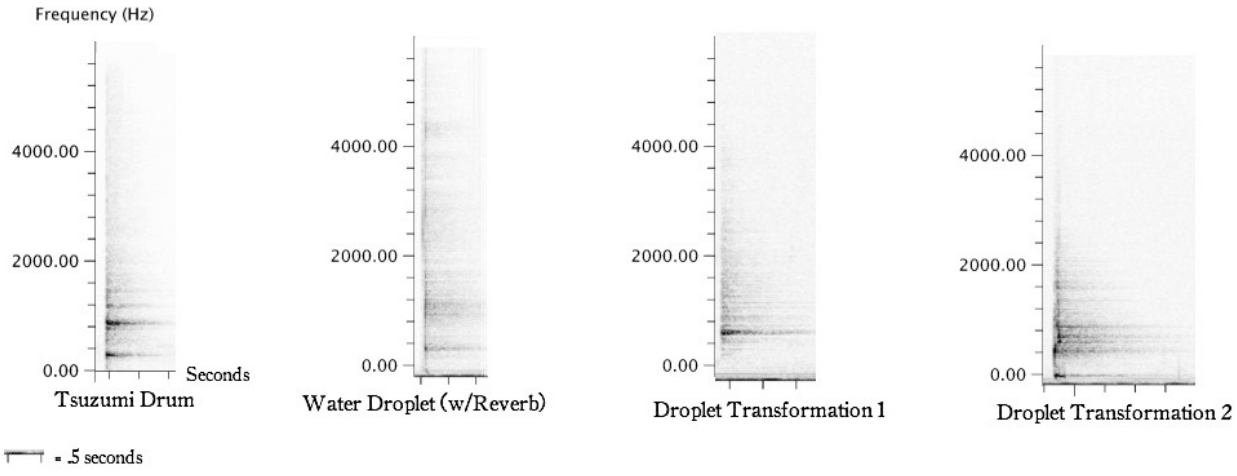
as an accompaniment to a work in another medium. As the name suggests, the source sounds used are all related to water. The musical material was all recorded in the Sogetsu Arts Center lavatory – Takemitsu wanted to record the sound of stones being dropped into a well, but did not specifically want the sound of splashing water.[426] Critic Heuwell Tircuit, who knew the provenance of the source material, thought listeners might figure it out and think the whole exercise was a joke, but it seems that no audience member ever did (or if they did, they did not let on.)[427]

Takemitsu makes extensive use of both undisguised sounds and heavily processed sounds in the work, though in either case, the result is generally a sound relatable to an aspect of water, be it water droplets, trickles, or torrents. His use of relatively unaltered sounds in the work does not imply that he was uninterested in timbre or timbral manipulation. The very basis of his ideas about sound in this period seem to suggest that he was fixated on the character of any given sound, be it natural or instrumental. Timothy Koozin recalls Takemitsu's definition of timbre as "the succession of movement within a sound."[428] While this is a somewhat nebulous definition, there are a number of qualities that change as the attack envelope gives way to the sustained sound, and, finally the decay and termination. Given this definitions, it is not surprising that the sound material for *Water Music* is often drawn out, typically with reverb. Even the most recognizable water-droplet sounds are generally given a great deal of reverb, giving a first impression that the work is unfolding in a cavern. The exception to this scheme is the transformation of the water droplet sounds to that of a traditional Japanese drum. Peter Burt describes the process, which involves giving the droplets "highly percussive envelopes that make them sound like a traditional Japanese

426 Burt, 45.
427 Burt 45.
428 Toru Takemitsu, *Time In Traditional Japanese Music*, quoted in Timothy Koozin, 59.

instrument, such as the *tsuzumi* of the *noh* ensemble."[429] The example below (fig. 4.13) shows a comparison of a tsuzumi drum strike, the first relatively untransformed water droplet sound of the work (reverberation is added, but otherwise there is minimal processing), and two later transformations of droplet material. Though they are by no means identical, the transformations show a number of similarities with the tsuzumi that are not present in the original droplet sound. The tsuzumi strike includes a sharp, defined attack, and while it has a broad spectrum of frequencies in the tone, includes emphasized pitch centers at around 300 Hz and around 900 Hz. The droplet sound lacks a sharp attack and shows a diffuse, broad-spectrum frequency range with no clear pitch centers. Both transformations bring out pitch centers to the sound, but the wide spread of frequencies still mean they still retain their semi-pitched impression. The first transformation has a clear attack, which helps it to sound like a cleanly struck drum. Though they are not exact replicas of the tsuzumi, the transformations show enough similarities that a comparison is viable.

Figure 4.13 – Comparison of Tsuzumi Strike with Sounds from *Water Music*



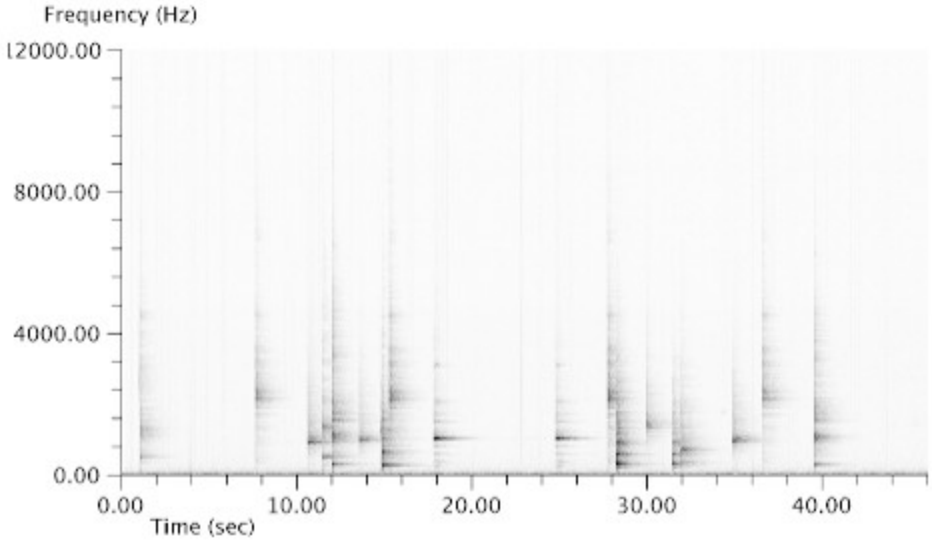
429 Burt, 45.

Takemitsu employs the droplet/tsuzumi sounds as a recurring aspect of *Water Music*, and it forms the basis for much of the musical material as it is developed throughout the work. The range of processing varies widely for these sounds, so that there is a full spectrum from undisguised-water to apparently-tsuzumi. This range creates a level of aural equation between natural and instrumental sound, since sounds from all over this spectrum are freely interspersed with one another. In addition to varying the pitch and loudness of musical material, Takemitsu uses density of sound attacks to create internal contrasts of ebb and intensification.

Water Music is 9'52" long, and I divide it broadly into four sections, with the last section further subdivided into two. The work's first section (0'00"-0'42") relies solely on the water-droplet/tsuzumi sounds, with a clear attack followed by reverberated decay. There are often several seconds of silence between these impulses, and the sparse texture and interplay between sound and silence create a stark first impression, drawing our attention to the sounds' intrinsic musical qualities.

Formally, this first section has a nearly palindromic quality to it, with the pivot point being at around 0'22". The two halves of the first section are not exact duplicates of one another (though the impulses on either side of the midpoint are exact copies of the same sound), but each half consists of nine similarly spaced impulses (see fig. 4.14). The general register of this section is fairly low, and the density of attacks are greatest roughly two thirds of the way through the first half, and the corresponding first third of the way through the second half.

Figure 4.14 – *Water Music*, Section 1



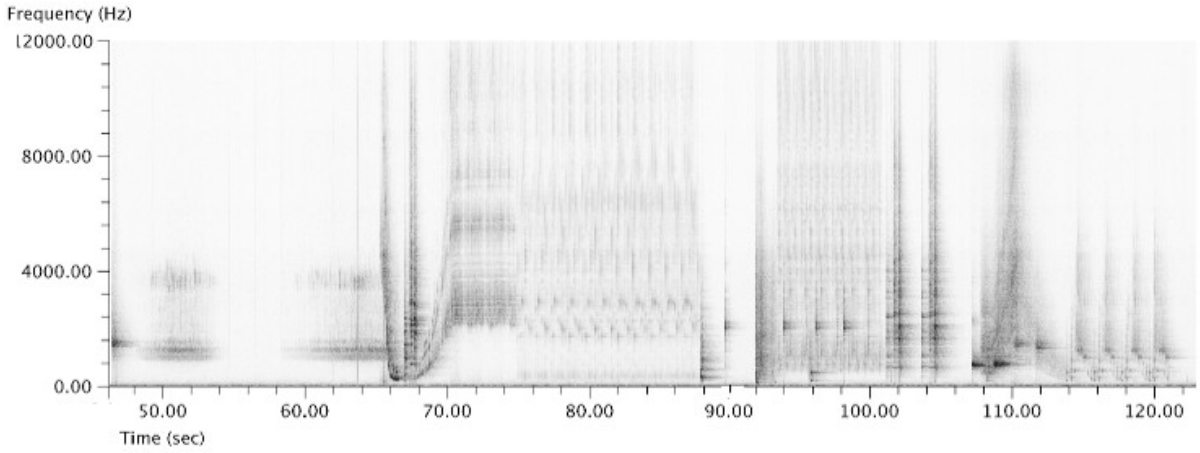
The use of a near retrograde raises a number of questions. The technology Takemitsu had available to him would have allowed him to easily create a more literal palindromic impression (simply reversing the tape would reverse the attack envelopes, but by careful copying, measuring, and cutting of the tape, could have made something functionally palindromic), so why did he opt for a vague impression of one? It is the idea of the palindrome that is important here – the structure is enough to create recognition of different sound characteristics, such as pitch and loudness, but avoids setting up the idea of a teleological direction of development for the listener. There does not appear to be any large-scale palindromic formal patterning to the piece (see the final figure of this chapter, 4.20, for a full spectrogram), which reinforces a more freely developing feel.

The second section of the work is separated by the first by roughly five seconds of silence, the longest duration of silence within the piece so far. While it begins with another percussive droplet, similar to those that made up the musical material of the first section, it also introduces several new sounds that will recur throughout the work. In the first of these

new ideas, Takemitsu uses small segments of sound, looping them to create an effect similar to running water. The speed and pitch of this material implies different rates of water movement, from trickles (see, for example, the stretch beginning at 1'15"), to more substantial streams (as in the passage at 1'33"). This section consists almost entirely of material generated by tape loop, or loop material and impulse material being played concurrently. I mark the section as lasting from 0'46" to 2'02" (see fig. 4.15), its termination point accompanied by a long duration of silence, as with the first section.

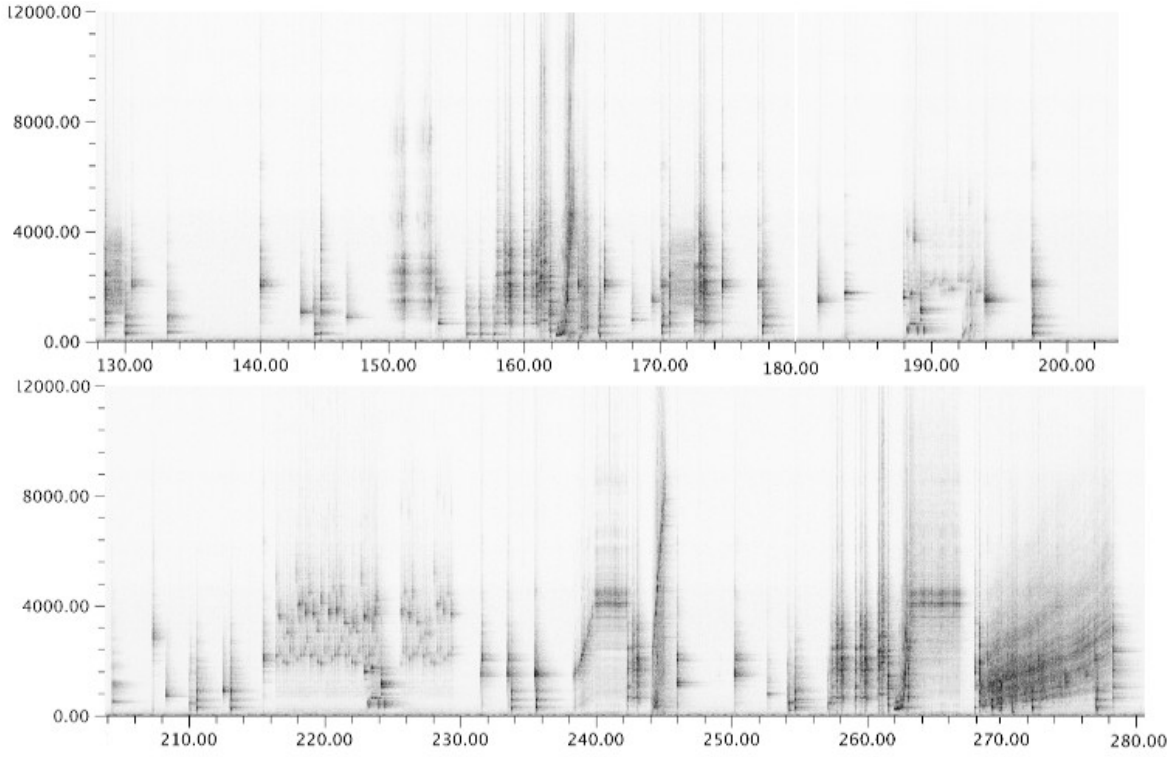
In addition to the loop-generated material, this section sees Takemitsu introduce two motivic components that will frequently recur over the course of the work, often paired with one another. The first can be heard three times in this passage, first at 1'07", then twice more, at 1'41" and 1'44". The provenance of this motive is well-disguised, though seems to be constructed of altered decays and attack points. The end result is a short fragment that sounds not unlike cards being shuffled. The second component is sound decay material, presumably played at acceleration in order to create a rapid rising effect. These fragments of sound material are so often paired that I will term the resulting sound-complex the "shuffle-upsweep" motive. While this motive changes over the course of the work, I believe the different iterations are similar enough that they can be classified together. The first two iterations occur in the example above at 1'07" and 1'42", though this second iteration is spread out over a full ten seconds, longer than the motive typically takes. Over the course of the piece, the motive becomes standardized, to the point that the last two iterations of it are exact copies. I will discuss the development of this motive below.

Figure 4.15 – *Water Music*, Section 2



The next portion of the piece does is not so easily broken into smaller sections. From 2'09" to 4'39" (see fig. 4.16), Takemitsu develops the materials he uses previously. Broadly speaking, he parallels the order of presentation of previous material by focusing mostly on sparser, impulse-decay generated material from 2'09" to 3'06" (though interrupted by an iteration of the shuffle-upsweep motive at 2'40"), and then loop-generated material from 3'06" to 4'39" (with another shuffle-upsweep at 4'17"), though it is by no means starkly divided. Running water effects are freely interspersed with the droplet/tsuzumi material. The section ends with a ramping of intensity, featuring some of the most dense material seen so far, from 4'17" to the end of the section at 4'39". The shuffle-upsweep motive gives way to a massive upsweep of wide-spectrum noise, played concurrently with a number of previously used droplet and tsuzumi-like impulses. The end of this section comes almost exactly halfway through the piece. Such a distinct and conspicuous moment has an air of finality to it – that the piece continues into a new section, formally unrelated to what came before, helps continue the non-directional impression established from the outset.

Figure 4.16 – *Water Music*, Section 3



I demarcate the final formal section as the last half of the piece, which can be further subdivided into two sections of nearly equal length (which I term 4 and 4^1). As can be seen below (fig. 4.18), each of these halves could be further divided into three subsections each: first starting with a sparser section of droplet/tsuzumi sounds, bookended by looped, broad frequency-spectrum decays to create noise, and continuing with an expanded version of the shuffle-upsweep motive (terminated with more noisy material, composed of slightly longer loops). Finally, each section finishes with another statement of sparser droplet/tsuzumi material. See below for a small table of subsections within sections 4 and 4^1(fig. 4.17), as well as the full spectrogram for this portion of the piece (fig. 4.18).

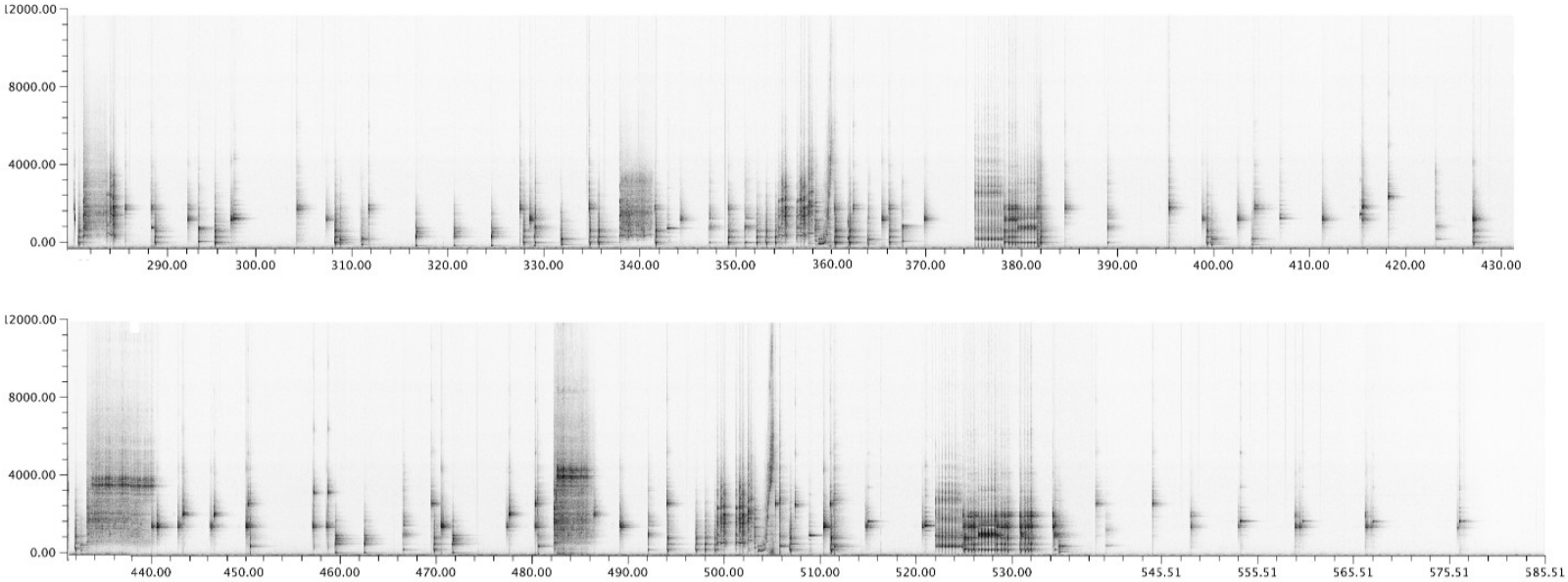
From a large-scale perspective, it is notable that though there are shared aspects across the piece, the extreme similarities between the last two quarters of the work give the

impression that it is somewhat starkly bisected, particularly given the extremely similar statements of the shuffle-upsweep motive. However, this impression is aurally undermined by keeping a similar scheme of alternating denser developed material with stretches of the sparser droplet/tsuzumi material throughout the earlier portion of the work, while at the same time varying the particular manifestations. The result is a tension between an apparent binary-type form visible in the spectrogram and the through-composed feel of the work which the first half sets up. This formal scheme is similar to aspects of *Piano Distance*, which, as mentioned above has a second half which can be bisected in a similar way as the second half of *Water Music.* In both cases, the two halves of each work could function as self-contained compositions but for some shared aspect with the previous section. In the case of *Piano Distance*, earlier motivic development ceases in favor of two subsections featuring running eighth note chords, with the tie to the first half of the first half of the work being a common source for pitch material and the recurring bell-like chord. In *Water Music*, 4^{1}'s near complete repetition of 4 ties the second half closely together, with the shuffle-upsweep motive and common source for sound material linking the two halves.

Figure 4.17 – Timings for Subsections within Sections 4 and 4[1]

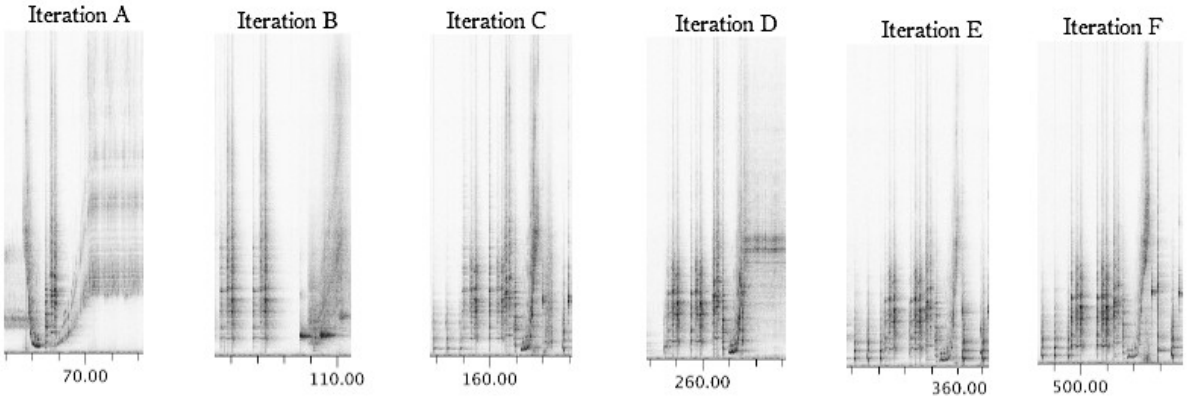
	Subsection 1	Subsection 2	Subsection 3
Section IV	4'40" – 5'38" (58 seconds)	5'38" – 6'22" (44 seconds)	6'22" – 7'10" (48 seconds)
Section IV[1]	7'11" – 8'02" (51 seconds)	8'02" – 8'56" (54 seconds)	8'56" – 9'52" (56 seconds)

Figure 4.18 – *Water Music,* Sections 4 and 4[1]



Though many individual sounds are reused and recombined frequently in the work, Takemitsu's cascading recombinations of the shuffle-upsweep motive seems to be one of the most salient aspects of motivic treatment in the work. I have supplied every instance of this motive in the work, labeling each iteration below (see. Fig. 4.19). I have shown 10 seconds for each, in order to give the context for the statement.

Figure 4.19 – Iterations of the Shuffle-Upsweep Motive in *Water Music*



The raw materials for this motive are first stated in iteration A, which gives the impression that the motive comes directly out of the looped "running water" material. It starts with a sharp sweep downwards, the bottom point of which coincides with a single shuffle fragment (in every other iterations, the shuffle is repeated). The upsweep then again transitions into more looped running water material, this time with a higher general frequency. Heard in isolation, the passage does not seem particularly motivic, but rather seems to punctuate and accentuate a transition from lower-frequency to higher-frequency looped material. In his discussion of *Piano Distance*, Koozin notes that "a motive or pitch grouping may at first hearing pass by in a stream of sounds without drawing our attention.

Later, as the figure is repeated, it acquires new referential meaning, reshaping our perception of the first hearing long after it has passed."[430] This principle is not reliant on an acoustic medium or traditional instruments, and works very well when applied to *Water Music*, as it describes precisely how the shuffle-upsweep motive is introduced.

Iteration B recombines the elements of the shuffle-upsweep motive, but undermines the established motive somewhat by the spacing inserted between the shuffle and the upsweep. Furthermore, the upsweep is more broad-spectrum than in Iteration A, which does nothing to reinforce this as part of a motivic scheme. However, the two key elements for this motive are there, and this iteration introduces the two shuffle sounds preceding the upsweep, which will become a staple of this motive as it is repeated and varied.

Iteration C adds new material, and becomes the template for iterations E and F. Three low droplet/tsuzumi attacks immediately precede the first shuffle, and a variant of the shuffle is inserted between the last shuffle and the upsweep. The spectrograms show the extreme similarity between this iteration of the motive and iterations E and F. iteration D, by contrast, reintroduces the direct transition into looped material that was seen in iteration A. The last two iterations of the motive, however, are nearly identical, with an important exception: in iterations C and E, the upsweep pans from left to right. In the final iteration, the upsweep pans right to left. Overall, the motive does not develop with a clear teleology, as even though the last two iterations are very similar, intermediate iterations reference earlier versions of the motive. The overall trajectory of this variation is not one of progressive development, but rather of a series of broadly related components that take shape as a connected motive through the course of the work.

430 Koozin, 66.

This trend of motivic development, especially when combined with the larger scheme of parallelisms without exact repetition, gives an impression similar to Deguchi's idea of *transformational motion,* in that over the course of the work, related motives are introduced, composed of the same components, gradually changing over time. Unlike *transformational motion*, however, the motive is repeated exactly, making it seem as though the development of the motive has settled on a specific version. This type of motivic scheme is in sync with Takemitsu's comments regarding compositional philosophy: through the course of the work, he captures a single defined sound[431] in the form of the shuffle upsweep motive, revealed from the larger field of sound. Though the shuffle upsweep complex is important, as it is one of the few sound combinations recognizable as something akin to a motive, it is infrequent enough to not dominate the flow of the music. The vast majority of the work is taken up by sections of material which, while similar, is not strictly recurrent. While he reuses his sounds, their varying placement in space creates a shifting but consistent tableau from which complexes of sounds recognizable as motives emerge.

On the micro level, Takemitsu has to shape every single sound in the work to some degree, since his source material is mechanically manipulated sound from the wider world. A large portion of the work's soundscape is taken up by the droplet/tsuzumi material juxtaposed with silence. One cannot help but ascribe some qualities of Noh theater to the work in light of similarities between Takemitsu's manipulation of the droplet sound and the traditional Noh drum. Koozin notes that in Noh drama, characters express emotions, but this effort is directed toward creating an atmosphere, rather than toward developing the character.[432] The drama will occur when an important moment in a character's life is uncoupled from its

431 Takemitsu, 8.
432 Koozin, 53.

"spatiotemporal context and projected into a dream universe."[433] This piece creates a similar impression: it is atmospheric, and has traceable developments without a clear motivic goal.

Technological manipulation allows Takemitsu to create a literal blurring of natural and instrumental sound, reinforcing a view of sound that is both traditionally Japanese and close to opinions of John Cage: there is no clear distinction between natural sounds and sound produced by instruments.[434] This particular combination of continuous water droplets and an instrument from a medium that frequently undermines linear time creates a backdrop of stasis. Both *Water Music* and *Piano Distance* rely on creating a stasis from which recognized material emerges, and to understand the significance of this practice, we must understand some of the Japanese philosophical themes that underpin it.

G: Ma*, Electronic Music, and Rediscovering Japanese Aesthetics*

Even if Takemitsu, during the composition of *Water Music*, was only beginning to rediscover an appreciation for traditional Japanese culture, he was still steeped in the prevailing philosophies of his country. The traditional Japanese conception of space, *ma*, is vital in understanding the genesis and drama of the piece. Other commentators have noted the usefulness of *ma* in understanding time in Takemitsu's work, though to my knowledge none have specifically highlighted *Water Music* as being emblematic of this concept. Jonathan Lee Chenette writes that Takemitsu tends to compose in a style structured in part by large and small-scale cycles, often where silences are critically important.[435] Chenette believes that these attributes are specifically reflective of *ma,* defining *ma* as "an interval of

433 Koozin, 52-53.
434 Koozin, 58.
435 Jonathan Lee Chenette, "The Concept of Ma and the Music of Takemitsu." http://adminstaff.vassar.edu/jochenette/Takemitsu_essay_Chenette.pdf (accessed 11/20/13), 1985, 1.

motion," and remarking that both space and time are conceived of in this way.[436] The linkage of space and time has profound effects on understanding even every-day phenomena. For example, the Tokaido road, which connected Kyoto and Edo, had fifty-three resting places. The space that the road covered would be thought of as "the interval of walking, organized by the stops for rest."[437] The marking of intervals, then, gives meaning to the space, while the presence of motion gives meaning to the intervals.

The concept of *ma* as it applies to music is often conceived of as the silence in between individual sounds,[438] but goes far beyond the simple dichotomy of sound and silence. *Ma* can "be a period of intense and meaningful waiting between successive events,"[439] as Koozin characterizes it. In a number of places in *Piano Distance* (see the first phrase, in fig. 4.5, for example), the performer must shape the sound as it decays and finally dissipates. Koozin notes this tendency in Takemitsu's piano works,[440] and believes that when musical gestures gradually fade in this manner, a listener is less likely to hear silences as strict partitions, instead, sound and silence are melded, and the silence becomes an active element in the piece rather than a passive one.[441] *Ma* can function in music on multiple layers. In the case of both *Water Music* and *Piano Distance, ma* can be understood to be applicable in a number of different ways, both on large formal levels and in the individual sounds that make up musical material. On the larger scale, both pieces rely on recognizable motives arising out of a seemingly static background to give structure. Koozin notes that in *Piano Distance,* "smaller repetition cycles nested within larger cycles form intervals of *ma* operating at various levels

436 Chenette, 2.
437 Chenette, 2.
438 Koozin, 54
439 Koozin, 54.
440 Koozin, 56.
441 Koozin, 57.

in the piece,"[442] Because of "the absence of any regular and predictable metrical background, repetitions of emphasized events become the principle means of marking time spans in the piece."[443] Similar multi-leveled cycles can be found in *Water Music*. Different iterations of the shuffle-upsweep motive act as markers, while the expanses of tsuzumi/droplet material form the background texture which the motives help to mark. On the micro level, each piece creates from its beginning a cycle between individual sound and silence, where a sharp attack marks the beginning of a sound even that gradually dies into silence. The longer the silences are prolonged, the more the listener expects the next sound. The multi-leveled *ma* cycles present in both works are integral in understanding how Takemitsu understood the act of composition at this time.

Given the similarities between these two works, it is tempting to draw a causal relationship between creating substantial works of *musique concrète* in the late 1950s and his acoustic development in the early 1960s. Such an argument would be difficult to prove, as it would require uncoupling Takemitsu's numerous artistic influences and personal compositional development at the time. Takemitsu's aesthetic preferences were already developing to favor spare textures and an emphasis on interplay between sound and silence. These preferences seem to have been formed by a multifaceted interplay of western avant-garde (Cage, in particular) and traditional Japanese ideas, and individual experimentation informed by these two realms. Jikken Kobo was certainly active in both in both theaters, and many of their projects involved the conspicuous combination of the quintessentially Japanese with the quintessentially Western Avant-Garde.[444] Takemitsu's work in the *concrète* medium

442 Koozin, 60-61.
443 Koozin,
444 See, for example, Jikken Kobo's production of *Pierrot Lunaire*, staged as a *Noh* theater production accompanied by Schönberg's music: Miwako Tezuka, "Experimentation and Tradition: The Avant Garde Play Pierrot Lunaire by Jikken Kobo and Takechi Tetsuji," in *Art Journal* 70, no.3 (fall 2011).

does not seem to have fundamentally altered how he thought about sound or composition, but may well have helped contribute to the way these interests coalesced, and shaped an identity of the Japanese avant-garde as a union between the traditional and insular, and the modern and western.

The lack of a clear causal relationship, however, does not imply that there is no correlation. By composing in *musique concrète*, a medium made possible by the technological advances and partnerships of the post-war economy, Takemitsu had a chance to work in the medium of pure sound in way fundamentally different from western acoustic music. This gave him an avenue to explore many of the aesthetic and philosophical principles which he was advocating at the time. In practice, this meant creating a musical work out of material that would not be considered conventionally motivic, shaping individual sounds to create a slowly developing framework that arising from and receding back into silence. This scheme also fits *Piano Distance*, which shows these traits to a far greater extent than works even only slightly earlier, like *Uninterrupted Rests.* Takemitsu associates many of these same characteristics, namely a preoccupation with the character of an individual sound over more conventionally motivic material, and that it challenges measurable time.[445] There are a number of Japanese composers who, when disillusioned with Western acoustic avant-garde techniques like serialism, seem to have found an appreciation for traditional Japanese music after or in concert with experiments in electronic music or *musique concrète.* Even if access to new technologies and ideas is only one small facet for reevaluation of an indigenous art form, it is evidence of an evolving toolset for knowledge production, and the enterprise falls within the type 2 paradigm.

445 Takemitsu, 6 and 8.

In his comparisons to western classical music, Takemitsu tends to speak specifically about Japanese traditional court music, or *gagaku. Gagaku* ensembles are constructed of a number of string, wind, and percussion instruments – Takemitsu singles out the *kakko* and *taiko* drums, and *sho* (mouth organ) as being what gives a rhythmic backdrop to the piece, though is quick to point out that there is no concept of a beat, at least in Western terms.[446] He notes these instruments "serve only to embroider the gossamer curtain of intricate sound."[447] Takemitsu uses the example of *gagaku* to contrast with the measured, mathematical way silence is effected in Western music, and believes that the functionalistic limitations imposed on sound rob it of its intrinsic strength. Though he is careful to note that he is unsure *gagaku* specifically "revives the basic power of sound,"[448] he sees promise in the "stream of sounds" that comprises a performance of *gagaku*. Takemitsu claims he did not want to specifically promote the revival of g*agaku.*[449] Rather, he expressed a desire to apply these ideas to contemporary music.

Takemitsu contrasts the "stream of sounds" of *gagaku* with his take on the Western compositional method: "the usual construction of music – that of superimposing sounds on one another,"[450] and implies that the difference lies in how music is conceived of as a space. Western music measures time and divides it with the help of graphic notation. Sound in this system, according to Takemitsu, "has lost its strength within the limitation of functionalism."[451] In essence, Takemitsu wants the sound to escape the confines of such a construction, and be allowed to be an object in itself, an ethos traditionally unusual for

446 Takemitsu, 6.
447 Takemitsu, 6.
448 Takemitsu, 7.
449 Takemitsu, 8.
450 Takemitsu, 7.
451 Takemtisu, 7.

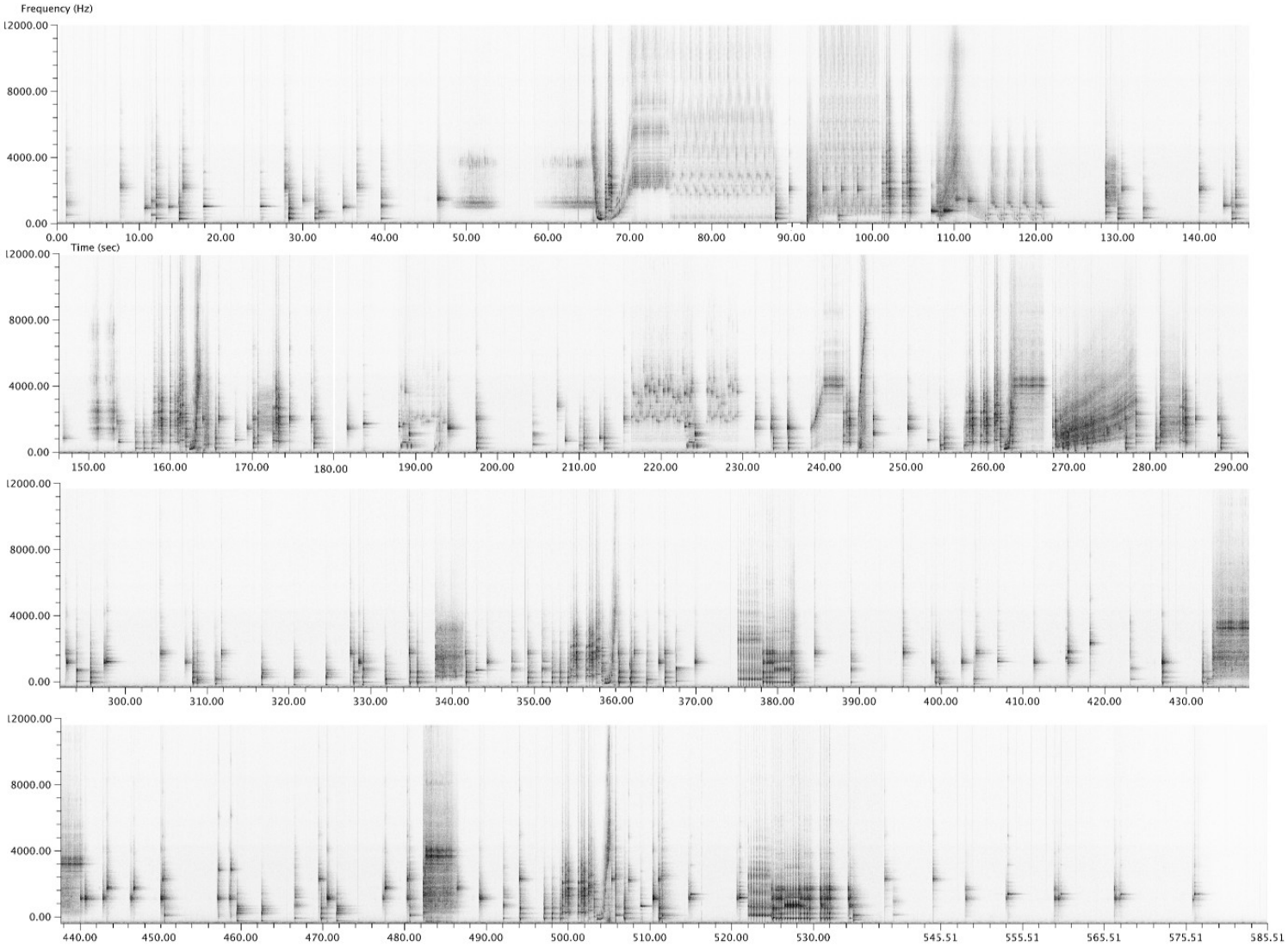
Western music. However, this is a similar sentiment to Shaeffer's *objet sonore*:[452] in *gagaku*, sound is freed from a functional framework and is allowed to exist as an end in itself, while the *objet sonore* is heard without hearing the cause behind it. In either case, the sound is liberated from a framework becomes an end in itself. Working in a medium where these ideas can be applied and developed granted Takemitsu an avenue to connect his cultural background to what is essentially an imported art form (but to which he was nonetheless deeply connected).

A number of Japanese composers at this time were also struggling with an identity for Japanese contemporary music, and from early on, electronic composers of the NHK studio turned to Japanese traditional music to create a uniquely Japanese expression of the avant-garde. Toshiro Mayuzumi, in particular, saw the promise in combining the mediums. His first *concrète* work, *X, Y, Z*, made use of a *gagaku* ensemble as components of its source material.[453] Both Mayuzumi and Makato Moroi became somewhat disillusioned with the serialism of European contemporary music,[454] and turned to mixing Japanese traditional music with electronics as a means to create uniquely Japanese contemporary music. Mayuzumi created a number of works which "married the techniques of Western electronic music to the principles, or rather sounds, of traditional Japanese music."[455] In her account of these works, Loubet notes that though both composers understood and referred to Western musical structure, their primary concern in their electronic works was using the natural material "to find the quickest route to sonic expression."[456] This is placed in opposition to the Western idea of constructing a cogent system on which the composition rests. Loubet notes

452 A concept with which Takemitsu was familiar – see Takemitsu, 27-28.
453 Loubet, 13
454 Loubet, 16.
455 Loubet, 16.
456 Loubet, 17.

that these composers never addressed the question of whether the use of Japanese traditional elements is compatible with forward-looking avant-garde techniques. Though Mayazumo and Moroi may not have addressed this, Takemitsu, in his comments about *gagaku* raising possibilities for contemporary music, seems to have felt that there was nothing inherently contradictory in combining the philosophical aesthetic of Japanese traditional music and contemporary Western music, at least as he understood the genres. Ultimately, Takemitsu's works with Jikken Kobo, and those in the electronic studio, provided a testing ground for addressing the problems facing many of his contemporaries: what does modern Japanese music look and sound like? The solution for Takemitsu and others was a synthesis of using new technology, imported musical techniques, and traditional Japanese aesthetic philosophy, all made possible by collaborations which fit many of the characteristics of the mode 2 paradigm.

Figure 4.20 – Spectrogram of *Water Music*



Concluding Thoughts:

The creation of electronic music studios in the 1950s and early 1960s represents a unique moment in time, for a number of reasons. Artistically, these studios offered new possibilities to composers trying to pursue new directions in modern music. Technologically, they required collaboration between technical and artistic personnel; their creation required engineers, acousticians, physicists, and composers. Culturally, their creation was interwoven with the emerging postwar order, as countries sought to rebuild themselves, governments embarked on massive pushes to develop new technology as part of their Cold War efforts, private industry looked to capitalize, and artists sought to understand their place in it all.

The three case studies I present are not meant to be exhaustive, but are well-suited to a comparison, and establish something of a pattern. The circumstances of their creation have much in common, and all of them operated in the same (roughly) decade-long time span. Each case was located either in the United States or in a country that was a former axis power, and had backing from a private concern who sought to develop the technology for their own ends. This type of collaboration, based on solving specific, application-based problems, is well representative of the characteristics that characterize Mode 2 knowledge production, and presaged similar examples that followed shortly after the time-frame of my study.

The Mode 2 paradigm, typified by a transdisciplinary, application-based approach to problem-solving, stands in contrast to the Mode 1, patronage-based model that tends to typify avant-garde artistic production; artists look to create according to their particular tastes, schools, or ideologies, even if operating in a group. However, this was impossible for those seeking to work in an electronic medium – studios were not yet widely established, and the

establishment of these studios required resources and expertise most composers simply did not have. This required collaboration between experts from a variety of fields, and though the collaborators had a unified goal in creating or testing equipment, their ultimate goals where, at times, divergent. In some situations, this led directly to the abandonment of these projects by the backing companies, as was the case with both RCA and Siemens.

Though each of my case studies has some broad similarities regarding the development and establishment of the respective studios, the significance of the studios' creation for the composers and companies was, naturally, highly individual. All the projects in question can be regarded as artistic successes for the composers who made use of their respective facilities. It is interesting to note that the less insular the composer's artistic goals were, the greater the success of the projects in question for the companies involved. In each case, we see how the technology ideologies of the studios helped to inform the music produced there.

Milton Babbitt sought to develop a comprehensive serial organization for his music, which had to be performed precisely to communicate its meaning. The RCA synthesizer's capabilities were well-suited to this narrow goal, and we can see the influence of the precision made possible by the device in Babbitt's early acoustic works using his time-point system, as in *Sounds and Words*. While the synthesizer was important for the development of Babbitt's brand of serialism, and clearly had a role in shaping the conception of musical time that led him to develop the time-points system, the machine itself was hardly broadly marketable – its opaque, cumbersome interface limited its broader appeal, and so accomplished little for RCA, who did not have a clear plan for the device.

By contrast, Siemens had a very clear idea for what they wanted to accomplish with their electronic music studio, and with the help of Josef Anton Riedl, used it to make a soundtrack

for their award winning film. Its initial purpose fulfilled, the company liquidated its stake, but not before producing soundtracks to a number of industry films, and providing space for a number of composers like Mauricio Kagel to operate. Part of Siemens's plan for the studio after the completion of the film was to rent it to composers to work, and its non-partisan aesthetic stance, coupled with interdisciplinary bent, provided a space for Kagel to further develop his concept of *instrumental theater* in *Antithese*, playing with the idea of the theatricality of performance in a medium that is generally non-performative. The equipment of the studio was well suited to creating a work that blurs the line between creation and reception.

Finally, Sony's partnership with Toru Takemitsu's art collective, Jikken Kobo, gave Sony a proving ground for new technology, and allowed the group to forge a uniquely Japanese identity within the avant-garde. Takemitsu looked to older forms of Japanese art and music for inspiration, and used Sony's Electronic Music Studios to create a work the tape work *Water Music*, which transforms natural water droplet sounds into the sound of the *tzuzumi*, a traditional Japanese drum. The work eschews large-scale formal development in favor of subtly varying small motivic units – a thread which he would continue to explore in his works, both acoustic and electronic, for many years to come.

A: Other Developments in Mode 2 and the Electronic Medium

As studios became established, many became more oriented towards the Mode 1 model – this is completely expected, as Gibbons et al. note that as products of Mode 2 work themselves become institutionalized, they often take on a disciplinary character of their own (the writers use computer science as a specific example of this). This is another unique aspect

to the studies that I have chosen: they all exist at a time shortly before a larger trend towards inward-looking institutionalization began in earnest in the development of electronic music. However, that does not imply that Mode 2 approaches in electronic music ended with the initial establishment of studios, or that all developments at these stages were examples of Mode 2. It is worth briefly investigating three examples that followed shortly after this time period: John Chowning and the development of FM synthesis, Robert Moog's synthesizer, and the development of MUSIC-N languages by Max Mathews at Bell Labs (the last of which happened concurrently with my studies). The latter is notable in that though it took place in the context of private industry, there was much about it that fits the Mode 1 paradigm, and did not have as readily identifiable a direct application for the company as my studies did. The former two developments were highly profitable, have a number of Mode 2 aspects, and give some clue as to what within electronic music would prove to be broadly marketable. Understanding the circumstances of these cases helps to better situate the status of Mode 2 within the development of electronic music more generally.

In his book, *Investigating Interdisciplinary Collaboration*, Cyrus Mody uses Stanford in the late 60s and early 70s as a case study. The situation he describes: forming partnerships between departments to work on solving specific problems,[457] has much in common with the Mode 2 model. Strictly speaking, it generally lacks the private industry component Gibbons et. al describe as characteristic of Mode 2, but the approach is quite similar, and, since many of the efforts ended in profitable products for the university, this detail seems less important. Mody writes that the leadership at Stanford understood the inherent interdisciplinarity at the heart of problem-oriented research. He quotes Stephen Kline, cofounder of Stanford's

457 Cyrus Mody, "An Electro-Historical Focus with Real Interdisciplinary Appeal: Interdisciplinarity at Vietnam-Era Stanford," in *Investigating Interdisciplinary Collaboration* (Rutgers University Press, 2017) 175-176.

Values, Technology, and Society program: "'The kinds of questions that do and should concern the students are: Do you build the SST [supersonic transport], and what is being done about smog? Questions of this sort cannot be seen clearly through the viewpoint of any single discipline.'"[458]

This approach carried through to spheres of research throughout Stanford. Diverse groups of researchers founded a number of interdisciplinary centers. One such center was the Stanford Artificial Intelligence Laboratory (SAIL), which was instrumental for Chowning's development of FM synthesis. Mody recounts the story:

> In 1964, an undergraduate SAIL programmer, David Poole, was playing the tuba in the Stanford orchestra near John Chowning, a percussionist and graduate student in the Music Department. Poole heard that Chowning was interested in computer- generated music and suggested Chowning use SAIL's computers. Les Earnest, SAIL's deputy director, was supportive, and Chowning became a fixture in the lab. Over the next decade, Chowning acquired enough international stature, funding, and local supporters to spin off from SAIL and found the Center for Computer Research in Music and Acoustics (CCRMA—pronounced "karma," naturally).[459]

Andrew J. Nelson describes CCRMA's achievements in *The Sound of Innovation.* He describes the center's purpose:

> . . .to produce and manipulate sound, and, more importantly to them, the sonic basis of new musical compositions. In the process, they helped to develop a new academic field, to invent the technologies that would underlie this field, and to transpose these inventions into broad commercial application, reaching consumers in every corner of the planet.[460]

Within this system, Chowning and others were able to work on a number of specific problems – in 1967, he developed the algorithms for frequency modulation (FM) synthesis as part of an effort to emulate the qualities of acoustic instruments.[461] The algorithms were fairly simple, and could be easily processed by early synthesizers. Consequently, Stanford was able

458 Mody, 176.
459 Mody, 186.
460 Andrew J. Nelson, *The Sound of Innovation: Stanford and the Computer Music Revolution* (Cambridge: The MIT Press, 2015), 2.
461 Holmes, 306.

to license the patent for FM synthesis to Yamaha, in what would become one of their most profitable patents in its history.[462] The demand for a clear tie to earlier musical instruments, whether in the emulation of their sound or their appearance, would prove to be a consistent factor assessing the commercial viability of many electronic music technologies.

One of the most interesting aspects of this success is the fact that CCRMA's mandate was not to develop marketable products, per se. As Nelson writes, it was very much driven by concerns within music composition, writing that "underpinning this technological history is a musical one. Indeed, CCRMA's technological contributions must be understood, first and foremost, as facilitators of compositional aims."[463] In this case, the coming together of experts in different fields, with a mandate for exploration within music composition, generated an extremely profitable development. The same is true in the development of the Moog synthesizer.

Moog's work occurred in a less institutional context, but there are similarities, and understanding what made it and the FM patent profitable help to give a wider view to the larger place of Mode 2 collaboration within electronic music. Robert Moog had degrees in electrical engineering and physics from Columbia and Cornell and was at Columbia during the time that the Columbia-Princeton music center was beginning, his interest in electronic music came later..[464] He was interested in the Theremin, and after attending a concert of electronic music by his friend Herbert Deutsch, became enamored with the idea of working to produce equipment for composers working in this medium.[465] Moog and Deutsch worked together, using voltage-controlled oscillators, filters, and amplifiers to create an instrument

462 Mody, 187.
463 Nelson, 2.
464 Holmes, 209.
465 Holmes, 209.

capable of live performance (though the initial prototypes lacked a keyboard input).[466]

Moog and Deutsch demonstrated early versions of the synthesizer modules at the Toronto Electronic Music Studio, and it attracted positive attention from a number of composers there,[467] but at the time there was not really a way into mainstream markets. In their article "The Social Construction of the Early Electronic Music Synthesizer," Trevor Pinch and Frank Trocco believe that the key to the Moog synthesizer's eventual commercial success was the keyboard interface. They write:

> It is worth considering how few new musical instruments become commercially viable and mass-produced. If a new instrument does come along, how do people recognize that instrument and its sound, and how does it get incorporated in corpus of musical culture? In the history of the synthesizer, there is a path that can be traced from the Moog, through the Mini-Moog (a hard-wired Moog with no patching), to the Yamaha DX7 (the first commercially successful digital synthesizer), and all the myriad Casio keyboard synthesizers. In this developmental path, the synthesizer finally becomes a version of the electronic organ, only with a greater range of voices and special effects. The first step in this process is the idea that the keyboard is the preferred interface.[468]

Other early synthesizers, like the RCA synthesizer and Buchla's synthesizer, lacked a keyboard, and for good reason: these were new instruments, designed to create new sounds and new music. Don Buchla rejected a keyboard for his synthesizer, because, as Pinch and Trocco note, he felt it was "restrictive to use an old technology associated with wires and hammers with the new source of sound."[469] This limited its accessibility to the wider public, however. A keyboard was an optional module for Moog's synthesizer from fairly early in the development process. Even before they became standard for the synthesizer, Moog understood their significance for publicity purposes, saying (regarding publicity photos),

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466 Holmes, 210.
467 Trevor Pinch and Frank Trocco, "The Social Construction of the Early Electronic Music Synthesizer," in *Icon* vol. 4 (1998), 15.
468 Pinch and Trocco, 19.
469 Pinch and Trocco, 17.

"The keyboards were always there, and whenever someone wanted to take a picture, for some reason or other it looks good if you're playing a keyboard. People understand that you're making music."[470]

The inclusion of the keyboard as standard would prove to be integral to the Moog's success because of the type of music it facilitated. In 1969, composer Wendy Carlos released *Switched on Bach*, an album of Bach pieces performed on the Moog. The record was a top 10 seller on the Billboard 200 chart, and made Moog and Carlos famous.[471] One of Moog's students (who later acted as a sort of spokesman for the synthesizer), Jon Wiess, notes the significance of the album:

I could see the difference, and there was a world of difference pre-'Switched on Bach', and post-'Switched On Bach'. Before 'Switched On Bach' came out, the synthesizer was basically resigned to well-to-do academic institutions, a few private individuals, very few ... And it was pretty much considered lunatic fringe, there's no question about it, you know, weird space sounds ... there was some rigid thinking about what's music and what isn't music, what's permissible and what's not, and then Carlos came along. Like Wham, and then suddenly the world thought, 'Oh yeah, this is great ... [472]

Moog turned a profit from synthesizers beginning in 1969, and though the market collapsed soon afterwards,[473] synthesizers were now an indelible part of the popular music landscape, and the technology was commercially viable. The circumstances of the success of these two technologies, produced in the context of the collaborative, application-focused context that marks Mode 2, are instructive when assessing the legacy and potential for Mode 2 within electronic music, and allows us to understand why some of the avant-garde composers in the era of my study might have made less-than-ideal partners for private industry than, for example, popular musicians. Both the FM algorithm and Moog's

470 Robert Moog, quoted in Pinch and Trocco, 16.
471 Pinch and Trocco, 20.
472 Weiss, quoted in Pinch and Trocco, 21.
473 Pinch and Trocco, 28.

synthesizer had novel applications for music , but which could still be definitively tied to established musical norms. The synthesizer had a keyboard, which suggested using a twelve-tone tuning system. FM could be used to create rough emulations of acoustic instruments using minimal computational power. Both of the qualities allowed the wider public to understand their musical significance; they could situate a synthesizer in their understanding of music because keyboards were ubiquitous, and they could appreciate FM synthesis because it allowed approximation of instruments with which they were already familiar. Creating something wholly new that has wide appeal is a much more difficult proposition. Avant-garde composers were (and are), generally, exploring the new: new sounds, new methods of organization, and new ways of conceiving of music generally. If a musical technology needs a tie to established conceptions for it to be a commercial success, this puts the larger goals of a composer at odds with the larger goal of the company, at least implicitly, and may help to explain why, after the first phase of invention, other collaborations had more longevity.

This is certainly an aspect of why the RCA synthesizer was not profitable – Babbitt had no interest in a machine that did not further his idiosyncratic goals for perfecting serial organization, and the RCA mark II reflected those priorities. This also helps to explain why Siemens and Sony both liquidated their stakes in their respective electronic music studios. Siemens got what they needed out of their studio; artistic novelty served well for a company that was trying to reinvent itself. But once their identity was established, it seems that being a patron for further musical experimentation was outside the purview of the company mission. Similarly, it was useful for Sony to employ Jikken Kobo as testers and demonstrators for speculative technologies. Once they had developed the technologies they knew were

marketable, however, company resources could be more profitably spent than providing space for an avant-garde art-collective to experiment. The lack of relative longevity of each of these cases might be tied to the very specific application they each fulfilled, which fundamentally revolved around promotion, with actual product development as being secondary. The can be contrasted with the research patterns at Bell Laboratories during this same time period, which were far more speculative, but ended up having more far-reaching consequences.

Max Mathews developed the MUSIC program while working at Bell Labs in the 1950s. At his time, Bell Labs began researching different ways of digitizing audio signals over phone lines – converting the analog signal into numerical samples on one side, then converting back to audio on the other end.[474] In using computers as an aid in this, technicians realized the possibilities of transmitting music in the same way, and it was in this context that Mathews began to explore synthesizing sound directly using the computer, and the result was the MUSIC I and MUSIC II programs (released 1957 and 1958, respectively).[475]

This was a crucial development, as in many ways it practically launched computer generated music as a possibility. However, this research was not undertaken with a particular consumer target. It was application-based in the sense that it sought to develop a specific means to an end, but also highly theoretical, in that this research had no clear consumer application planned. Mathews, in a 2009 interview with Tae Hong Park, describes the genesis of his development of MUSIC, as well as the research structure of Bell Labs at the time:

474 Manning, 187.
475 Manning, 187.

I also was very lucky that I had a boss who was very smart, very famous, very lucky, and very powerful. His name was John Pierce, and he's best known for the invention of, or the propagation of, communication satellites. Pierce was very interested in music . . . He invited me to many concerts, and we went together. At one of these, a local pianist played some [Arnold] Schoenberg, which was very good, we thought, and some [Karl] Schnabel, which we detested. In the intermission, John suggested to me that perhaps the computer could do better than this, and that since I had the equipment to convert computer-digitized tapes into sound, I could write a program to perform music on the computer.[476]

This seems a prosaic enough back-story, certainly, and starts to sound very much like a patronage system, but located within a private company. What is interesting is that rather than develop this with a specific product in mind, the research seems to have been speculative. Mathews continues, describing the research environment at Bell Labs:

. . .the support for the research department . . . came as a lump sum to the vice president in charge of research, and then he assigned various amounts of money to the various departments, and it was a very generous support, so that no one really had to spend time writing proposals, going out searching for money, and competing with associates . . . My job for most of the time when I was at Bell Labs was managing the Behavioral and Acoustical Research departments. And these were experimental psychologists, physicists, some engineers - mostly electrical engineers - and some computer scientists. I always felt that my job was to try to recruit people who seemed both very smart and who seemed interested in problems that were broadly related to the work of the Bell System communications. But when I say "broadly," we could study how the human ear worked physiologically and even try to deduce how the cortex worked, understand such things as masking of one sound of another in speech or in music, so we could support basic research in these areas. So I always tried to find people that I thought were both smart and interested in useful problems. But then I would explain to them that when they came, they would have to choose their own work and that we're not going to hand them a problem to work on, and they both had to be able to recognize useful problems and make some progress on them or eventually we would figure someplace else for them to work.[477]

This paints the picture of a remarkably freewheeling research division, with quite a lot of latitude regarding the projects they pursued. In many ways, this reads as a hybrid Mode 1/Mode 2 endeavor. The research at this initial stage was mostly theoretical, and initially discipline focused, but was combined with others' research, with the goal of being developed into more concrete applications later. Additionally, the knowledge produced had to be

476 Tae Hong Park, “Interview with Max Mathews,” in *Computer Music Journal* 33 no. 3 (Fall, 2009), 10.
477 Park, 15.

transdisciplinary in character, since it was being applied to still-developing fields.

The product in this case, MUSIC, was software for creating computer music, and could be adapted to new hardware. This meant that the project had legs far beyond its original development at Bell Labs. The code was developed by Mathews and others over the next several decades, making it an incredibly important, enduring product. The circumstances surrounding the development of the MUSIC software underscore a particularly important aspect of the Siemens and Sony situations, which both casts their Mode 2 characteristics in stark relief and, perhaps, gets at what the companies believed electronic music meant within the broader culture of the time.

Both cases differ crucially from that of Bells Labs in a few important respects. First, the products Siemens and Sony worked on were hardware, rather than software. That MUSIC was software meant that it was more easily ported and altered by developers as new technology allowed. Though this detail is not as important for my purposes, it is, I believe, crucial to the longevity of MUSIC, and must be taken into account. The software was rather narrowly disciplinary in character – it was of use mainly to computer-literate composers, and very likely ran into the same problems outlined above, regarding broader acceptance by the general public, but the fact it could be perpetually adapted meant that interested specialists could always develop it.

The other reason (more pertinent to this study) for the relative brevity of the Siemens and Sony collaborations revolves around the missions of the collaborations in the first place. In each case, there was an immediate commercial goal for involving avant-garde musicians in the collaboration, and that goal revolved around promotion. Sony was developing consumer electronics, and believed that Jikken Kobo's artistry products could help to market specific

products. While Siemens's goal was more nebulous, it was similar: the studio was a way to show off their technical prowess and forward-thinking orientation, thereby stimulating business. In both cases, companies felt that involving composers of electronic music would reflect positively on them, whether that meant showing the possibilities for their products (in the case of Sony) or showing an avant-garde company sensibility, which presumably translated into an image of advanced sophistication (in the case of Siemens). When that moment in time passed, the collaborations naturally ended.

One of the characteristics of Mode 2 is that, being application based, once a problem is solved, resources are then redistributed, and this was precisely the fate of the collaborations I have examined. The relative brevity of these collaborations is likely the result of the newness of this technology in general; companies realized that it was viable to develop technology used to create electronic music, but what exactly was this music for? The initial technology itself was developed, later collaborations could have a decidedly less speculative bent, as developers worked to solve specific problems within electronic music itself (e.g. viable emulation of acoustic instruments within the limits of modest processing power, or ways to develop electronic instruments with mass-appeal).

The period of early development of these electronic music studios is significant in that establishing the studios, if they were to be useful, required collaboration between the scientists and engineers, who understood the technical aspects, and composers, who understood the practical application of the technology. After establishment, avant-garde electronic music itself became institutionalized to the point that the context in which it appears is very similar to the Mode 1 model of academic composition more generally. However, as my case studies have shown, the period of 1955-1965 saw a number of

situations where art-music reflected ascendant models of research and knowledge production. These collaborations had wide ranging artistic and technological effects, for the composers themselves, but also for the wider cultural landscape. This was a period where the avant-garde, through the electronic medium, were able to tap into a futurist impulse that pervaded the intellectual landscape. Rather than being a relic of the past, art-music composers who embraced electronic media were on the cutting edge of cultural production, and so had an inroads to popular culture that had not been seen for hundreds of years prior, and has not been seen since. It was a moment in time when private industry and the arts worked together to create what might have been the music of the future.

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